Centennial Corridor Project

City of Bakersfield and Kern County, CA

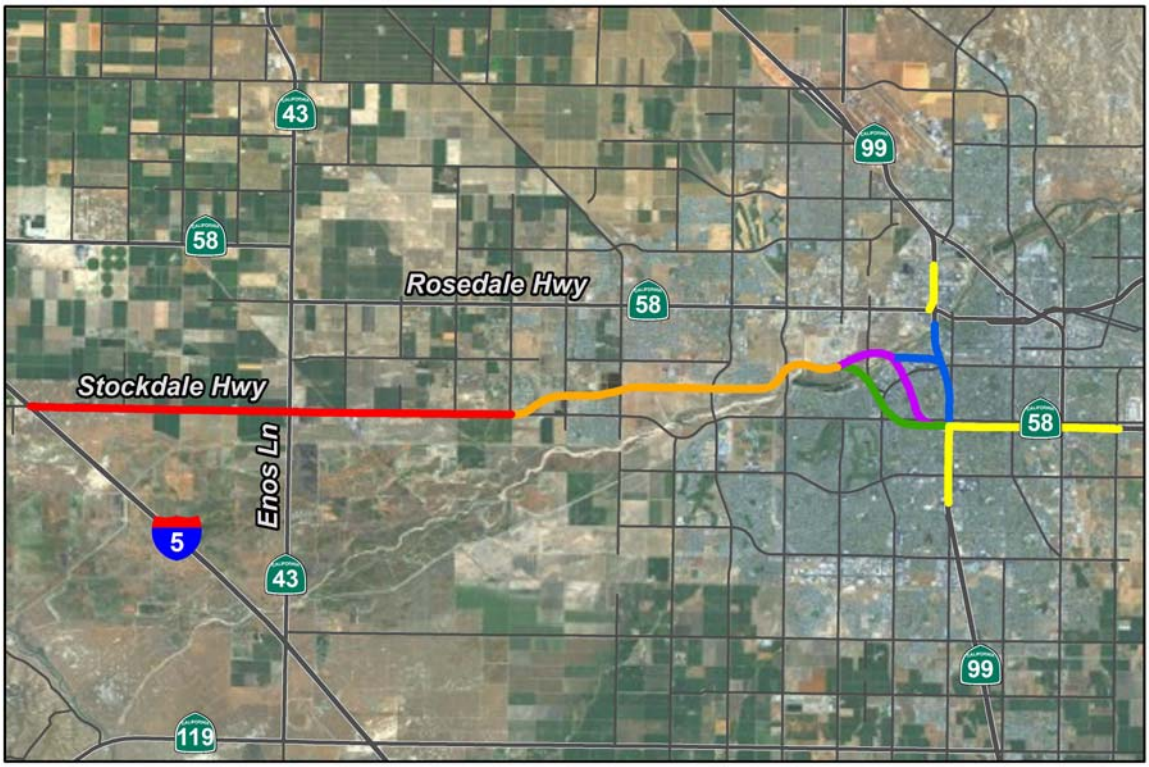
District 06 - KER – 58 - PM T31.7 to PM R55.6

District 06 - KER – 99 - PM 21.2 to PM 26.2

Project ID # 06-0000-0484

SCH #2008091102

Final Location Hydraulic Study



November 2012

(Revised March 2014)

Caltrans

Final
Location Hydraulic Study

Centennial Corridor from State Route 99 to Interstate 5

City of Bakersfield and Kern County, CA

District 06 - KERN – 58 - PM T31.7 to PM 55.6

District 06 - KERN – 99 - PM 21.2 to PM 26.2

Project ID# 06-0000-0484

November 2012

STATE OF CALIFORNIA

Department of Transportation

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Acronyms

Caltrans	California Department of Transportation
HEC-RAS	Hydrologic Engineering Center - River Analysis System
I-5	Interstate 5
NAVD 88	North American Vertical Datum of 1988
SR	State Route

Section 1 Introduction

The California Department of Transportation (Caltrans) proposes to establish a new alignment for State Route 58, which would provide a continuous route along State Route 58 from Cottonwood Road on existing State Route 58, east of State Route 99 (post mile R55.6), to Interstate 5 (I-5) (post mile T31.7). Improvements to State Route 99 (post miles 21.2 to 26.2) and Westside Parkway would also be made to accommodate the connection with State Route 58.

The project is located at the southern end of the San Joaquin Valley in the city of Bakersfield in Kern County, California. The study site is bound on the east by Cottonwood Road, on the west by I-5, on the north by Gilmore Avenue, and on the south by Wilson Road. Caltrans is the lead agency for the project pursuant to the California Environmental Quality Act and the National Environmental Policy Act.

The proposed continuous route, known as the Centennial Corridor, has been divided into three segments, as shown in Figure 1-1.

Segment 1 is the easternmost segment, which would connect the existing State Route 58 (East) freeway to the Westside Parkway. Multiple alignment alternatives are being evaluated for this segment and are discussed below.

Segment 2 is composed of the Westside Parkway, which extends westerly from Truxtun Avenue to Heath Road. This roadway is a local facility that is currently under construction and would be transferred into the State Highway System. The analysis evaluates potential impacts associated with incorporating the Westside Parkway as part of the State Highway System, as well as improvements to the Westside Parkway from Truxtun Avenue to the Calloway Drive interchange which would be made to facilitate traffic operations between the Westside Parkway and the Centennial Corridor. The analysis reports the relevant results of the *Westside Parkway Environmental Assessment/Final Environmental Impact Report* and provides updates, as necessary.

Segment 3 would extend from Heath Road to I-5. This segment will need a temporary route adoption for the use of Stockdale Highway between Heath Road and I-5 as an interim alignment for State Route 58. A future new alignment (ultimate) as identified in the 2002 *Route 58 Route Adoption Project Tier I Environmental Impact Statement/Environmental Impact Report* (EIS/EIR) will be constructed when there is greater traffic demand and funding is available. Since traffic would use Stockdale

Highway between Heath Road and I-5 on an interim basis, the potential impacts will also be evaluated for the interim use of Stockdale Highway. Improvements to the Stockdale Highway/State Route 43 (known locally as Enos Lane) intersection would be made to accommodate the additional traffic.

1.1 Purpose and Need

The purpose of the Centennial Corridor project is to provide route continuity and associated traffic congestion relief along State Route 58 within Metropolitan Bakersfield and Kern County from State Route 58 east (at Cottonwood Road) to I-5.

State Route 58 is a critical link in the state transportation network that is used by interstate travelers, commuters, and a large number of trucks. Under existing conditions, State Route 58 does not meet the capacity needs of the area, and this is expected to get worse as the population grows. State Route 58 lacks continuity in central Bakersfield, which results in severe traffic congestion and reduced levels of service on adjoining highways and local streets. This route is offset by about 1 mile at State Route 43 and by about 2 miles at State Route 99. The merging of two major state routes (58 and 99) into one alignment between the eastern and western legs of State Route 58 degrades the traffic level of service on this segment of freeway. In addition, State Route 99's close spacing for its two interchanges with State Route 58 (East and West), in addition to an interchange at California Avenue, results in vehicles aggressively changing lanes, which adds to the congestion.

1.2 Project Description

The project alternatives include three build alternatives and a No-Build Alternative.

1.2.1 No-Build Alternative

No construction of Segment 1 would occur under the No-Build Alternative. In addition, no improvements to the Westside Parkway from Truxtun Avenue to the Calloway Drive interchange would be required There would also be no improvements made to the Stockdale Highway/State Route 43 intersection. The No-Build Alternative would involve the following actions: (1) the Westside Parkway would be route adopted into the State Highway System; (2) the portion of Mohawk Street from the Westside Parkway to Rosedale Highway would be designated as part of State Route 58, which would provide a connection to State Route 99; (3) Stockdale Highway between Heath Road and Interstate 5 would serve as an interim alignment for State Route 58 until ultimate improvements are constructed; and (4) the portion of State Route 58 (West) from Allen Road to Interstate 5 would be relinquished to the local jurisdictions as a local facility.

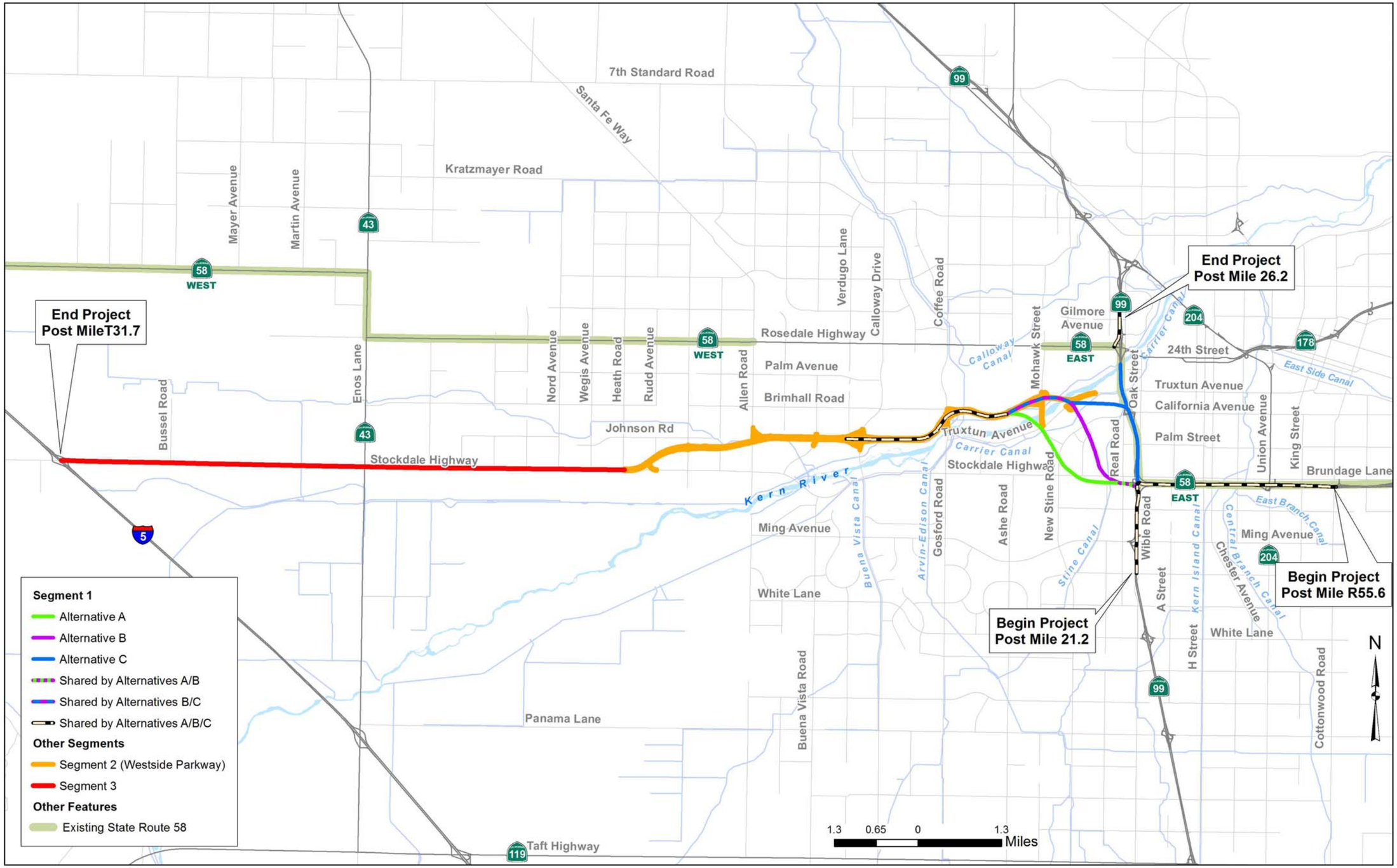


Figure 1-1 Segments of the Centennial Corridor

1.2.2 Build Alternatives

As shown in Figure 1-2, the three build alternatives (Alternatives A, B, and C) within Segment 1 propose new alignments that would extend from Cottonwood Road on the existing State Route 58 (East) and connect I-5 via the Westside Parkway. Alternatives A and B would be west of State Route 99, and Alternative C would parallel State Route 99 to the west. Under Alternative A, the eastern end of the Westside Parkway mainline would be realigned to conform to the Alternative A alignment, and ramp connections would be provided to the Mohawk Street interchange. Under Alternatives B and C, the alignments would connect to the Westside Parkway by extending the mainline lanes built as part of the Westside Parkway project. Detailed descriptions of the alternatives are provided on the following subsections.

1.2.2.1 Common Design Features of the Build Alternatives

The build alternatives would connect State Route 58 (East) to the east end of the Westside Parkway by means of a six-lane freeway. All the build alternatives would involve a route adoption to include the selected Segment 1 alignment and the Westside Parkway into the State Highway System as State Route 58. In Segment 3 the route adoption would include the adoption of Stockdale Highway as the interim State Route 58 connection to Interstate 5, as well as the designation of the ultimate alignment (the Cross Valley Canal alignment addressed in the 2001 EIS/EIR), which would be constructed at a later date. Though the alignment and design characteristics vary by alternative, the three build alternatives have the following common design features:

1.2.2.2 Segment 1

All the alternatives would provide the following connections between State Route 58 and State Route 99 using high speed connection ramps:

- Northbound State Route 99 to westbound Centennial Corridor
- Northbound State Route 99 to eastbound State Route 58 (East)
- Southbound State Route 99 to eastbound State Route 58 (East)
- Eastbound Centennial Corridor to southbound State Route 99
- Westbound State Route 58 (East) to southbound and northbound State Route 99.

Direct connector ramps from southbound State Route 99 to westbound State Route 58 are not being provided as part of this project. However, to accommodate this movement, the southbound State Route 99/Rosedale Highway off-ramp would have two lanes off the freeway and be widened to four lanes at the intersection with Rosedale Highway. Additionally, an auxiliary lane would be provided on State Route 99 from south of Gilmore Avenue to the State Route 58 (Rosedale Highway)

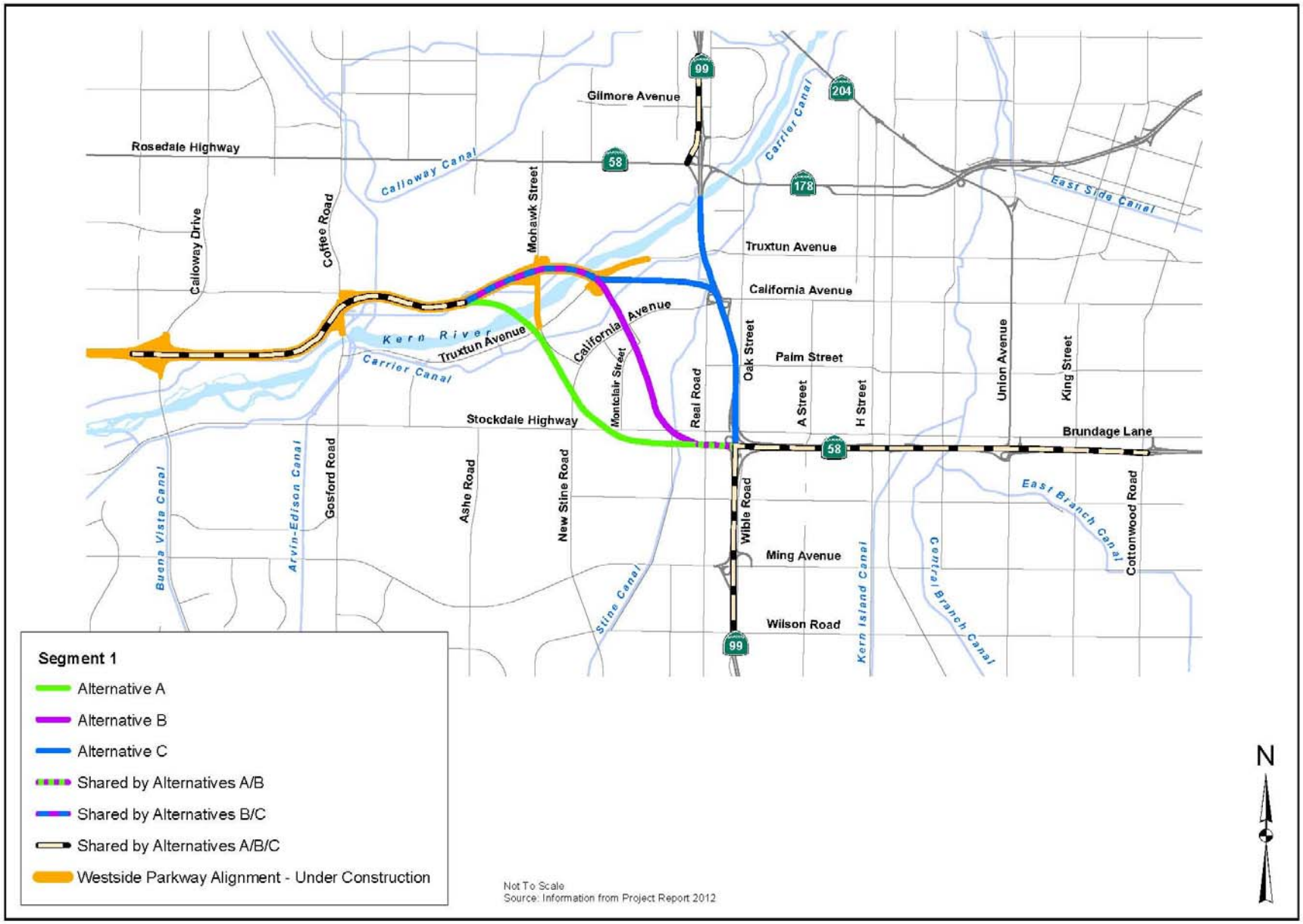


Figure 1-2 Segment 1 of the Centennial Corridor

off-ramp. Direct connector ramps from eastbound State Route 58 to northbound State Route 99 are not being provided as part of this project.

The project would require the widening of the South P Street Undercrossing and the westbound State Route 58 Grade Separation over State Route 99. In addition, the Stockdale Highway off-ramp from southbound State Route 99 and the Wible Road on- and off-ramps on State Route 99, located just south of the existing State Route 58/State Route 99 interchange, would be removed.

1.2.2.3 Segment 2

The Westside Parkway would be incorporated into the State Highway System with each of the Build Alternatives. Improvements to connect Centennial Corridor to the Westside Parkway would extend from where each build alternative connects at the eastern end of the Westside Parkway towards the west, ending at the Calloway Drive interchange. The proposed improvements would widen the Westside Parkway by constructing one additional lane in the median to provide auxiliary lanes. In the westbound direction, the median widening would extend from east of the Friant-Kern Canal through the Calloway Drive interchange. The limits of the added lane in the eastbound direction would differ between each alternative, as described in the Unique Design Features of the Build Alternatives section below. With each build alternative, modifications to the westbound diamond off-ramp to Calloway Drive and the eastbound loop on-ramp from Coffee Drive would be required.

Though the improvements described above are physically located in Segment 2, construction would be undertaken as part of Segment 1 construction to facilitate traffic operations between the Westside Parkway and the Centennial Corridor.

1.2.2.4 Segment 3

With each build alternative, the Stockdale Highway/State Route 43 intersection would be widened and traffic signals would be added to control the traffic movements. State Route 43 would be widened to add a dedicated left-turn lane in both directions. Stockdale Highway would be widened to add a dedicated left-turn lane and a shared through/right-turn lane in both directions. Though physically located in Segment 3, these improvements would be built as part of Segment 1 to ensure adequate traffic operations at this intersection.

1.2.2.5 Unique Design Features of the Build Alternatives

Alternative A

Design Engineering Features. Alternative A would travel westerly from the existing State Route 58/State Route 99 interchange for about 1 mile, south of Stockdale

Highway, where it would turn northwesterly and go over Stockdale Highway/ Montclair Street, California Avenue/Lennox Avenue, Truxtun Avenue, and the Kern River before joining the eastern end of the Westside Parkway near the Mohawk Street interchange.

A link would be provided from northbound State Route 99 to westbound State Route 58 and from eastbound State Route 58 to southbound State Route 99 via high-speed connectors. No direct connector ramps would be built from southbound State Route 99 to westbound State Route 58 or from eastbound State Route 58 to northbound State Route 99. Southbound State Route 99 would be widened to accommodate the additional traffic from eastbound State Route 58 to the southbound State Route 99 connector. The existing westbound State Route 58 to southbound State Route 99 loop-ramp connector would be realigned and would connect to the proposed eastbound State Route 58 to southbound State Route 99 connector before merging onto southbound State Route 99. The existing southbound State Route 99 to eastbound State Route 58 connector and northbound State Route 99 to eastbound State Route 58 would be preserved with some changes.

The limits of widening on State Route 99 would extend to the Wilson Road overcrossing. On northbound State Route 99, a three-lane exit would be provided just north of Wilson Road to carry the northbound State Route 99 to westbound State Route 58 traffic on two lanes and the Ming Avenue on- and off-ramp traffic on the third lane. All ramps in this area would have to be realigned to provide for the additional lanes. The Wible Road on- and off-ramps just south of the existing State Route 58/State Route 99 interchange, which is in conflict with the Caltrans standards of interchange spacing, would have to be removed to accommodate this design. The Stockdale Highway off-ramp on the southbound State Route 99 to eastbound State Route 58 connector would be removed as well. Under this concept, State Route 58 would also lose its link with Real Road. Also, Alternative A would provide an auxiliary lane on southbound State Route 99 from south of Gilmore Avenue to the Rosedale Highway off-ramp.

The median widening to provide an auxiliary lane along the Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp.

Other features with this alternative include 1) the construction of 19 soundwalls; 2) the construction of a park and ride facility off Mohawk Street, between California

Avenue and Truxtun Avenue, to replace the facility that would be displaced by the project; 3) 7 infiltration basins, which would be placed throughout the study area to retain stormwater runoff for water quality improvement purposes; and 4) 48 retaining walls of varying sizes located throughout the study area.

The maximum depth of excavation for Alternative A is 25 feet. This would occur near State Route 58 between Stephens Drive and H Street to accommodate the widened ramps. On State Route 99, the maximum excavation would be about 18.5 feet and would occur between Belle Terrace and Ming Avenue.

Drainage Engineering Features. A photo of the existing railroad bridge over the Kern River just upstream of the proposed project is shown in Figure 1-3. The profile of the existing bridge over the Kern River is shown in Figure 1-4. Figure 1-5 shows the Alternative A crossing of the Kern River, as well as where it crosses the Arvin Edison Canal, Friant-Kern Canal, Cross Valley Canal east of Coffee Road, Carrier Canal west of Mohawk Street, and Stine Canal just south of Stockdale Highway.

Figure 1-3 Existing Railroad Bridge over the Kern River

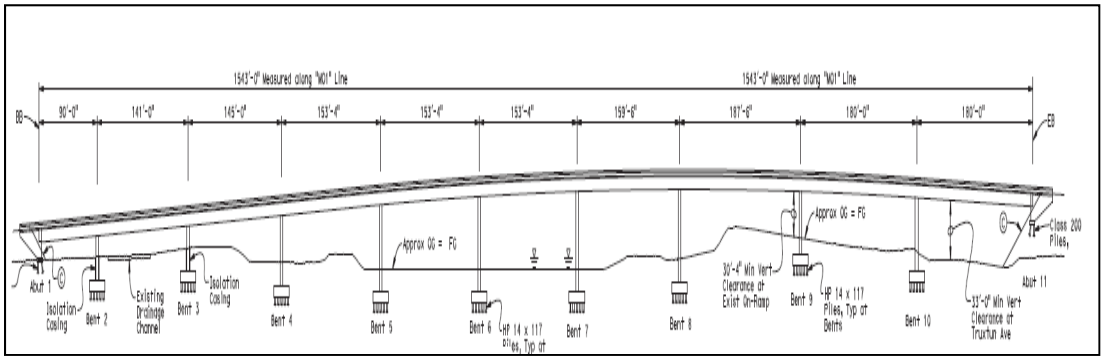


Figure 1-4 Profile of Existing Bridge over the Kern River

The existing bridge over the Friant-Kern Canal would be replaced by a 172-foot-long bridge. The plan is shown in Figure 1-6. An 855-foot-long box girder bridge with 5 piers is proposed over the Kern River. The profiles of the bridge over the Friant-Kern Canal and the Kern River are shown in Figures 1-7 and 1-8, respectively. The bridge spans vary in length from 110 feet to 160 feet.

Alternative B

Design Engineering Features. Alternative B would run westerly from the existing State Route 58/State Route 99 interchange for about 1,000 feet, south of Stockdale Highway, where it would turn northwesterly and span Stockdale Highway/Stine Road, California Avenue, Commerce Drive, Truxtun Avenue, and the Kern River before joining the east end of Westside Parkway between the Mohawk Street and Coffee Road interchanges. This alignment would depress State Route 58 between California Avenue and Ford Avenue. Overcrossings are proposed at Marella Way and La Mirada Drive to ease traffic circulation.

Alternative B proposes the same connections to State Route 99 that Alternative A does and would require similar improvements on State Route 99 and existing State Route 58.

The median widening to provide an auxiliary lane along the Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp. Modifications would be required to the eastbound Mohawk Street off-ramp, westbound Truxtun Avenue on-ramp, and the eastbound Mohawk Street loop on-ramp. In addition, construction of the proposed westbound Mohawk Street off-ramp and realignment of the Cross Valley Canal maintenance access road from Mohawk Street would be required.

Other features with this alternative include 1) the construction of 24 soundwalls; 2) the construction of a park and ride facility north of California Avenue, next to the Centennial Corridor, to replace the facility that would be displaced by the project; 3) 8 infiltration basins that would be placed throughout the study area to retain stormwater runoff for water quality improvement purposes; and 4) 42 retaining walls of varying sizes located throughout the study area.

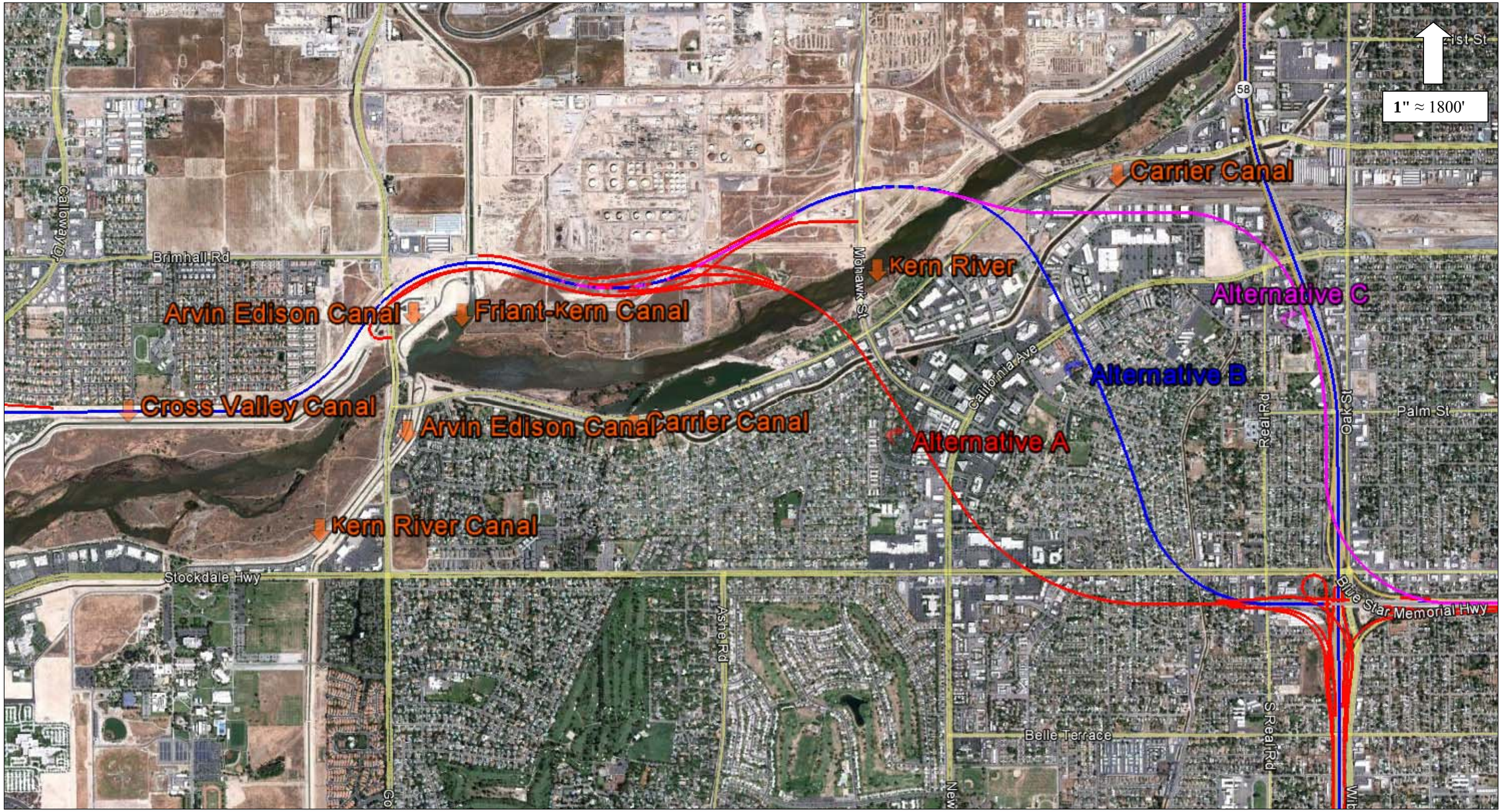


Figure 1-5 Segment 1 Crossings of Major Waterways by Alternative

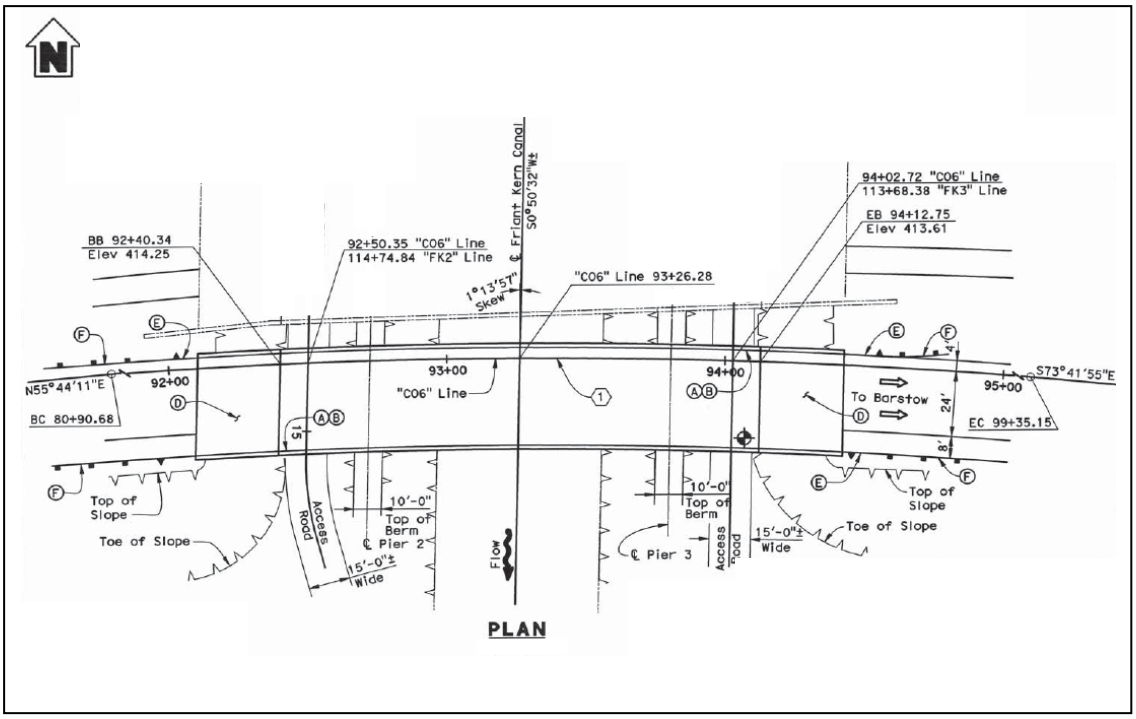


Figure 1-6 Plan of Proposed Bridge over Friant-Kern Canal

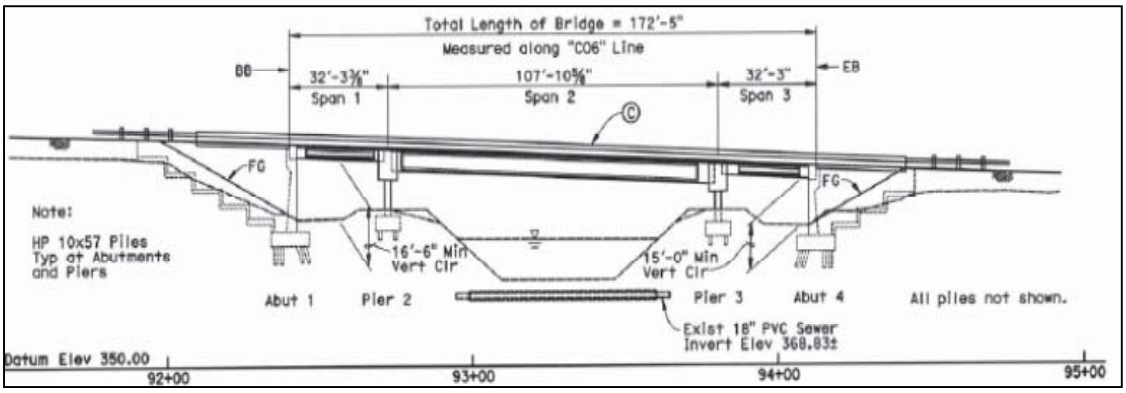


Figure 1-7 Profile of Proposed Bridge over Friant-Kern Canal

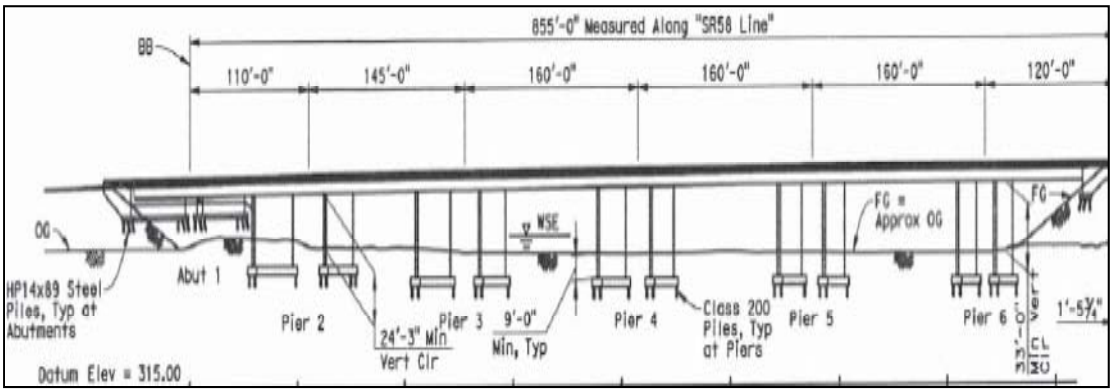
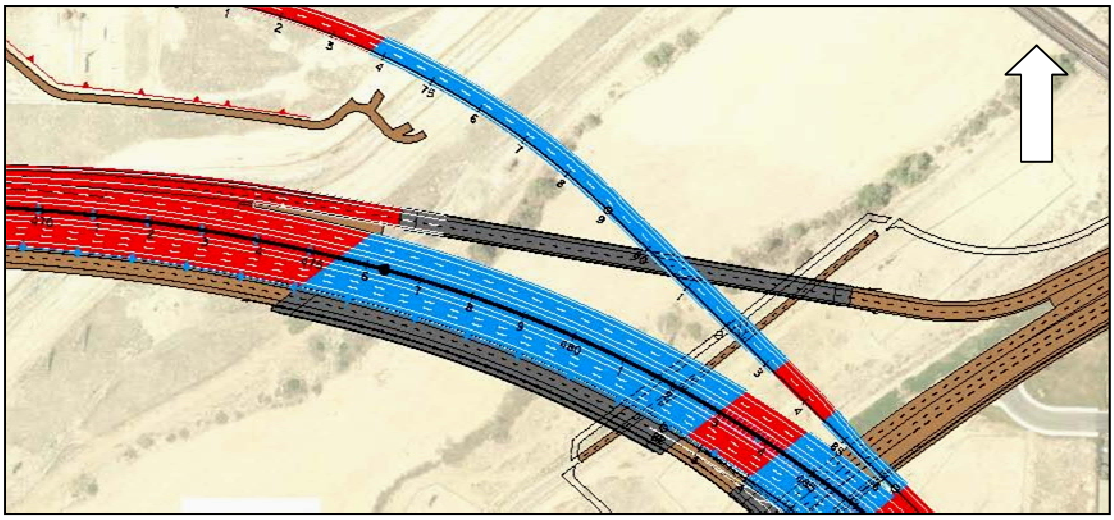


Figure 1-8 Profile of Proposed Bridge over the Kern River (Alternative A)

The maximum depth of excavation for Alternative B is 25 feet. This would occur near State Route 58 between Stephens Drive and H Street to accommodate the widened ramps and between California Avenue and Ford Avenue, where the freeway would be built below the existing grade. On State Route 99, the maximum excavation would be about 18.5 feet, between Belle Terrace and Ming Avenue.

Drainage Engineering Features. This alternative runs along the Cross Valley from Calloway Drive to Coffee Road, crossing the Friant-Kern Canal, Cross Valley Canal east of Coffee Road, and the Kern River and Carrier Canal between Mohawk Street and the existing BNSF railroad over the Kern River and Stine Canal just south of Stockdale Highway, as shown in Figure 1-5.

Alternative B proposes a 941-foot-long bridge off-ramp connecting westbound SR 58 to Mohawk Street. The plan for this bridge is shown in Figure 1-9, and the profile is shown in Figure 1-10. Alternative B also includes a proposed new 677-foot-long mainline bridge that would enable widening of the SR 58 mainline bridge over the Kern River, as shown in Figure 1-9. The profile is shown in Figure 1-11.



Note: Brown/Gray shades = existing roadways/structures; Red shades = proposed roadways; Blue shades = proposed structures

Figure 1-9 Kern River Bridge Widening and Westbound SR 58 Off-Ramp (Alternative B)

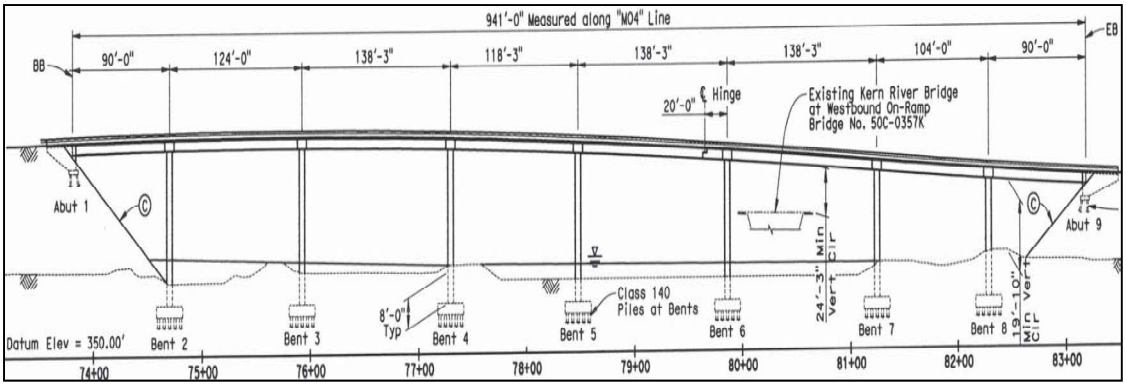


Figure 1-10 Profile of Bridge at Mohawk Street (Alternative B)

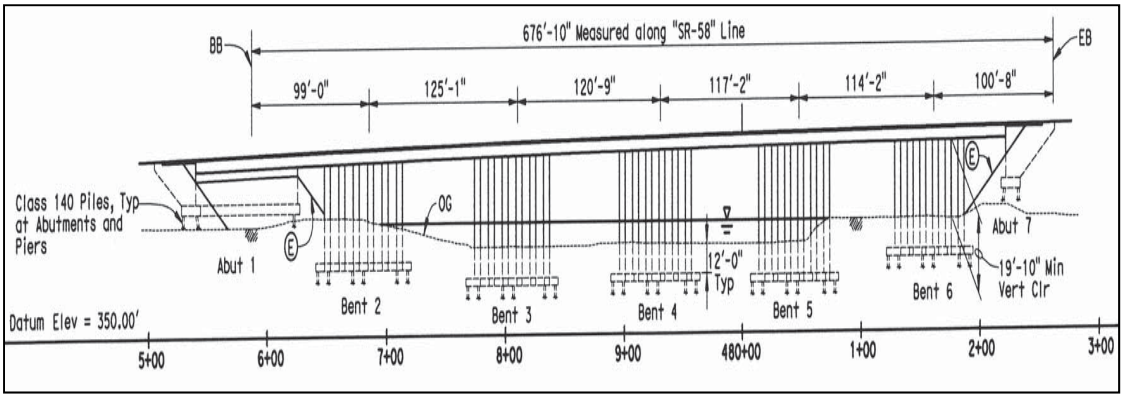


Figure 1-11 Profile of Bridge Widening over the Kern River (Alternative B)

Alternative C

Design Engineering Features. Near the existing State Route 58/State Route 99 interchange, Alternative C would turn north and run parallel to the west of State Route 99 for about 1 mile. The freeway would turn west and span the BNSF Railway rail yard, Truxtun Avenue, and the Kern River. This alternative proposes undercrossings at Brundage Lane, Oak Street, State Route 99, Palm Avenue, and California Avenue.

Connections would be provided from eastbound State Route 58 to southbound State Route 99 and from northbound State Route 99 to westbound State Route 58. The existing westbound State Route 58 to southbound State Route 99 loop-ramp connector would connect to the proposed eastbound State Route 58 to southbound State Route 99 connector before merging onto southbound State Route 99. The southbound State Route 99 Ming Avenue off-ramp would be relocated north of the eastbound State Route 58 to southbound State Route 99 connector to facilitate weaving between the Ming Avenue off-ramp and the eastbound State Route 58 to

southbound State Route 99 connector traffic. A connector would be provided east of northbound State Route 99 from Brundage Lane to south of California Avenue to facilitate weaving between westbound State Route 58 to northbound State Route 99 traffic with northbound State Route 99 to westbound State Route 58 traffic.

Improvements on State Route 99 would extend from the Wilson Road overcrossing (south of the State Route 58/State Route 99 interchange) to the Gilmore Avenue overcrossing (north of the State Route 58/State Route 99 interchange). A collector-distributor (C-D) road system would provide access from westbound State Route 58 to northbound State Route 99, as well as from northbound State Route 99 to westbound State Route 58. The Wible Road on- and off-ramps just south of the existing State Route 58/State Route 99 interchange would have to be removed to accommodate the northbound State Route 99 auxiliary lane. The Stockdale Highway off-ramp on the southbound State Route 99 to eastbound State Route 58 connector would be removed as well. Under this concept, southbound State Route 99 would also lose its link with Real Road.

The median widening to provide an auxiliary lane along Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp. Modifications would be required to the eastbound Mohawk Street off-ramp, westbound Truxtun Avenue on-ramp, and the eastbound Mohawk Street loop on-ramp. In addition, construction of the proposed westbound Mohawk Street off-ramp and realignment of the Cross Valley Canal maintenance access road from Mohawk Street would be required.

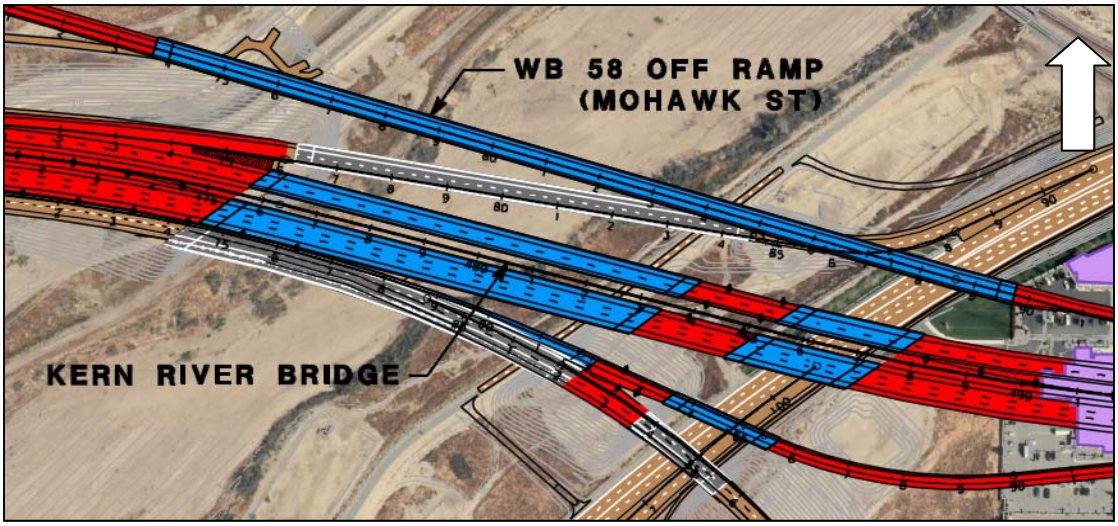
Other features with this alternative include (1) the construction of 17 soundwalls; (2) the construction of a park and ride facility at Real Road and Chester Lane to replace the facility that would be displaced by the project; (3) 11 infiltration basins that would be placed throughout the study area to retain stormwater runoff for water quality improvement purposes; and (4) 42 retaining walls of varying sizes located throughout the study area.

The maximum depth of excavation for Alternative C is 25 feet. This would occur near State Route 58 between Stephens Drive and H Street to accommodate the widened ramps. On State Route 99, the maximum excavation would be about 18.5 feet and be located between Belle Terrace and Brundage Lane.

Drainage Engineering Features. This alternative runs along the Cross Valley from Calloway Drive to Coffee Road, crosses the Friant-Kern Canal and Cross Valley

Canal east of Coffee Road, and crosses the Kern River and Carrier Canal between Mohawk Street and the existing railroad over the Kern River, as shown in Figure 1-5. Alternative C also crosses the Kern Island Canal and Central Branch Kern Island Canal, as shown in Figure 1-12.

Alternative C proposes a bridge off-ramp connecting westbound SR 58 to Mohawk Street, as shown in Figure 1-12. Alternative C also proposes a new 737-foot-long mainline bridge that would enable widening of the SR 58 mainline at the Kern River, as shown in Figure 1-12. The profile is as shown in Figure 1-13.



Note: Brown/Gray shades = existing roadways/structures; Red shades = proposed roadways; Blue shades = proposed structures

Figure 1-12 Kern River Bridge Widening and Westbound SR 58 Off-Ramp (Alternative C)

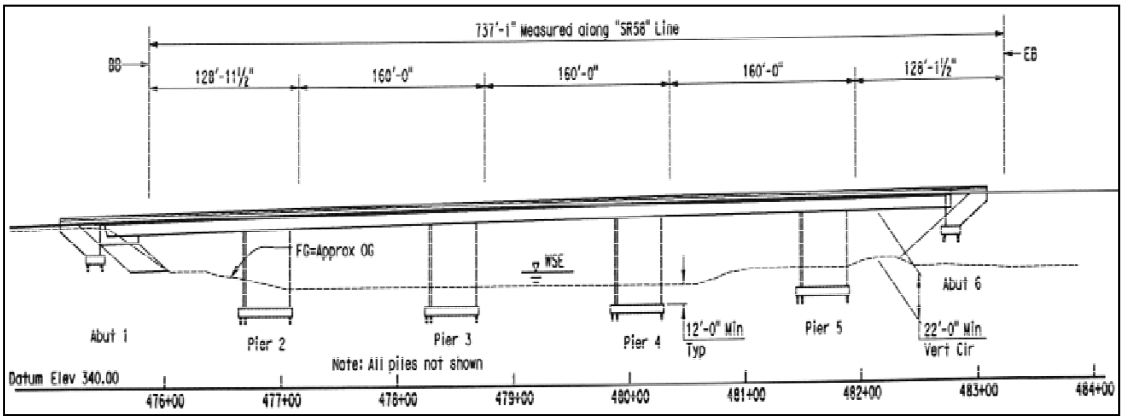


Figure 1-13 Profile of Bridge Widening over the Kern River (Alternative C)

The proposed drainage system for each alternative would maintain the existing drainage patterns and would route the onsite runoff to existing and proposed retention basins through the onsite drainage system. Since all runoff would be retained within these basins, there would be no hydromodification issues (i.e., no changes in offsite flow rate or quantity) as a result of the project. Onsite runoff would be routed via catch basins, drainage pipes, and pump stations to existing and proposed retention basins. A summary of the major components proposed for each Alternative (including existing facilities that require no improvement) is provided below.

- Alternative A: 21 retention basins, 4 pump stations.
- Alternative B: 23 retention basins, 7 pump stations.
- Alternative C: 19 retention basins, 9 pump stations.

1.3 Report Background

When a floodplain encroachment is anticipated, the Department is required to prepare a Location Hydraulic Study. The Location Hydraulic Study is a preliminary study of base floodplain encroachments and must be performed by a registered engineer with hydraulic expertise. If an increase in the base floodplain elevation is anticipated, then a hydraulic computer model must be run to determine the amount of increase to assess the potential floodplain encroachment impacts. Required content of the Location Hydraulic Study is described in Chapter 804 of the Highway Design Manual (Caltrans 2006b) and listed in Caltrans Standard Environmental Reference, Volume 1, Chapter 17, Floodplains (Caltrans 2011c).

This report provides a detailed analysis of the Segment 1 alternatives, along with a revalidation of information provided in the previous environmental documents prepared for Segments 2 and 3. This report documents Segment 1 impacts to the floodplain resulting from the proposed improvements identified for Alternatives A, B, and C, as described in the following sections. It specifically evaluates the bridge structure crossings over the Kern River for each alternative.

Section 2 Site Characteristics

2.1 Climate

The climate within the project area is characterized by hot, dry summers and wet winters with seasonal dense fog. Nearly all of the annual rainfall occurs in the 6 months from November to April, with an annual average precipitation of 5.4 inches (Caltrans 2006a). As determined by long-term records of temperature, in the Bakersfield area, the average minimum temperature, for the period from 1971 to 2000, was 38.2 degrees Fahrenheit in December, and the average maximum temperature was 96.9 degrees Fahrenheit in July (DWR 2011).

2.2 Topography

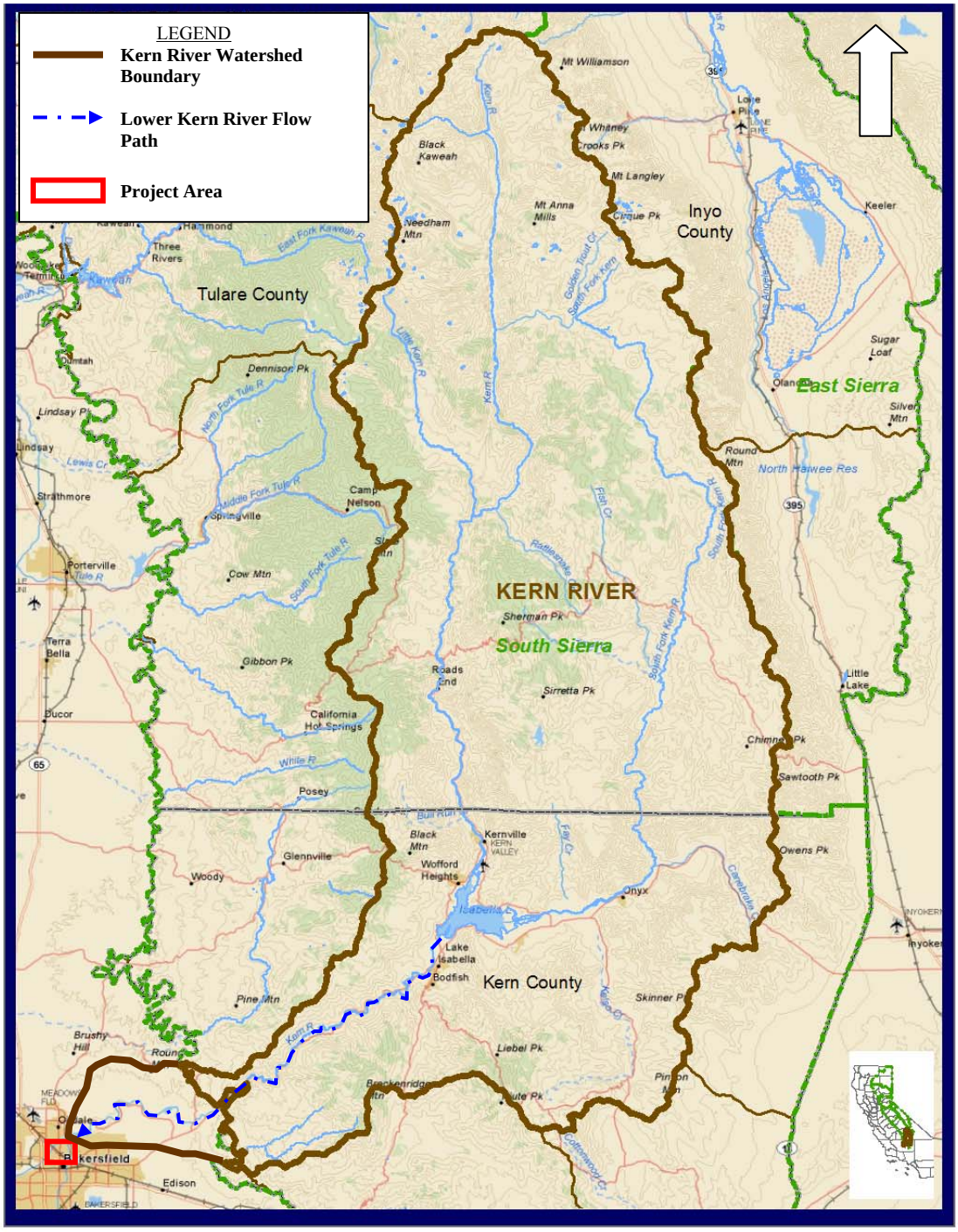
The general topography of the surrounding area primarily consists of flat land with sparse ridges and manmade berms. The average ground elevation in the proposed project vicinity is approximately 405 feet above mean sea level. The ground surface elevation varies from 360 to 530 feet within the project site (Caltrans 2011a). A 7.5-minute quadrangle topographic map of the project area is provided in Appendix B.

Runoff during rain events generally flows from northeast to southwest, parallel to the Kern River via sheet flow, and is intercepted by drainage ditches or inlets connected to a storm drain system that conveys the flow to existing vegetated swales and/or infiltration and retention basins.

2.3 Designated Floodplains

2.3.1 Kern River Watershed Characteristics

The project site is located in the Kern River watershed, as shown in Figure 2-1. The river is approximately 165 miles long and is largely fed by snowmelt originating near Mount Whitney. The "upper" Kern River originates in the southern Sierra Nevada mountains. It is the only major river in the Sierra Nevada mountain range that drains in a southerly direction. The watershed runoff flows south through the Sequoia National Forest and enters the Lake Isabella Reservoir, created by the Lake Isabella Dam. The "lower" Kern River originates from the flows immediately downstream of the dam. The Kern River flows southwest and continues collecting runoff from the Greenhorn Mountains. There, the river flow is partially controlled by the three irrigation canal diversion structures upstream of the proposed bridge locations in Bakersfield. Downstream, the river empties into the now-dry Kern Lake.



Base Map Source: Sierra Nature Conservancy

Figure 2-1 The Kern River Watershed Area at the Project Location

The major river crossing in the project reach is the Kern River, which flows in a broad channel with meandering thalweg[1]. The Kern River watershed at the project site is approximately 2,500 square miles; this estimate is based on a watershed area of 2,407 square miles at U.S. Geological Survey Gauge 11194000, located approximately 9 miles upstream on the Kern River (USGS 2008). Lake Isabella Dam controls 2,074 square miles of the Kern River watershed; the dam is located approximately 53 miles upstream from the project site (FEMA 1984). The remaining 426 square miles in the watershed are partially controlled by the three irrigation canal diversion structures (Beardsley, Carrier, and Calloway) upstream of the proposed bridge locations in Bakersfield. The proposed project would also cross the Gates Canal, Friant-Kern Canal, Emery Ditch, and Stine Canal. Figure 1-5 shows the crossings of all major waterways.

2.3.2 Description of Floodplain

Bakersfield experiences its most severe flooding from the Kern River as a result of high-intensity winter rainstorms. Snowmelt floods, which are typically longer in duration but have lower peak water surface elevations, are also common in the spring, but they rarely cause significant damage.

In a 2008 Flood Insurance Study, the Federal Emergency Management Agency conducted hydrologic and hydraulic analyses of the Kern River to determine the extent and severity of flooding for Bakersfield (FEMA 2008). The Kern River is also under the jurisdiction of the Central Valley Flood Protection Board (CVFPB) as a designated regulatory floodway. The peak flow rates associated with the 10-, 50-, 100-, and 500-year return period events, used by the CVFPB for this section of the Kern River, are higher than those provided in the Flood Insurance Study and are listed in Table 2-1.

Table 2-1 Kern River Flood Peak Discharges

Return Period (years)	Annual Probability of Exceedance	Peak Discharge Rate (cubic feet per second)
10	0.10	2,800
50	0.02	7,000
100	0.01	15,000
500	0.002	30,000

The Kern River 100- and 500-year floodplains occur within the project area for all segments of the Centennial Corridor Project. Flood control measures currently in

[1] A thalweg is defined as a line drawn to join the lowest points along the entire length of a streambed or valley in its downward slope, defining its deepest channel.

place along the Kern River in the project vicinity include flood control levees on both sides of the river, Coffee Road Bridge, a diversion structure upstream of Coffee Road, and Carrier Canal and adjacent levees. All of these improvements are designed to provide flood protection.

Section 3 Project Conclusions

The aforementioned Flood Insurance Study for Kern County, including incorporated and unincorporated areas, was reviewed for hydrologic and hydraulic data (FEMA 2008). A detailed hydraulic analysis was performed on the Kern River. Flood profiles, based on these studies, are available in the Flood Insurance Study.

3.1 Risk Assessment

As shown in Figure 3-1, the Flood Insurance Rate Map for Kern County, California, and Incorporated Areas (2008) shows that the proposed bridges (for the three alternatives) would be located in Zone AE. Zone AE represents areas that are subject to flooding by the 100-year flood event, and base flood elevations are shown within these zones. The Alternative A bridge would be within the floodplain, and the water surface elevation would range between 389 and 391 feet North American Vertical Datum of 1988 (NAVD88). The Alternative B bridges would be within the floodplain, and the water surface elevation would range between 393 and 396 feet NAVD88. The Alternative C bridges would be within the floodplain, and the water surface elevation would range between 393 and 397 feet NAVD88. The Flood Insurance Rate Maps covering the project area are FIRM 06029C2276E, FIRM 06029C2277E, FIRM 06029C2281E, FIRM 06029C2282E, and FIRM 06029C1818; these are included in Appendix C.

3.1.1 Hydraulic Analysis

3.1.1.1 Methodology

The Kern River hydraulics were analyzed with a standard step backwater calculation using the U.S. Army Corps of Engineers' Hydrologic Engineering Center River Analysis System (HEC-RAS), Version 4.1, computer program. The analyses were performed for the existing condition and three proposed condition alternatives for use in the analysis of the neighboring proposed bridges at Mohawk Street and Westside Parkway. This model incorporates both of these previously proposed bridges into the existing condition for the current analysis. Elevations in the model originally referenced the NAVD88.

In accordance with Caltrans standards (Central Region Hydraulic Design Criteria), proposed drainage facilities would be designed for a 25-year, 5-minute storm event, and basins would be designed for two 10-year, 24-hour storm events. The Central Valley Flood Protection Board adopted the Federal Emergency Management Agency's '1981 Interim Levee Policy and Issuance of 44 CFR 65.10', requiring a minimum of 3-feet of freeboard, "with provisions for exceptions for lower freeboard

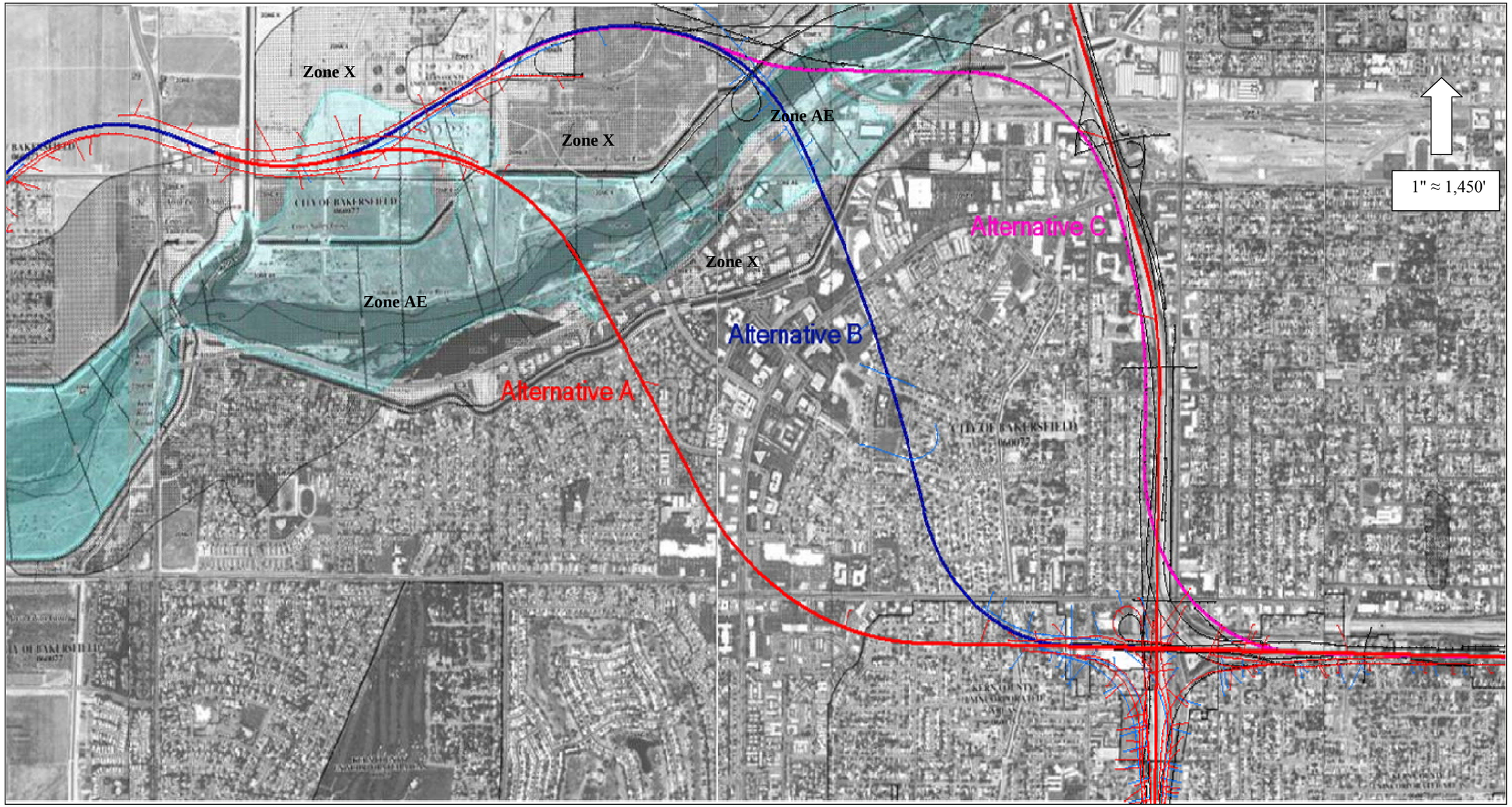
where the applicant demonstrated a lower level of uncertainty" (Interagency Levee Policy Review Committee 2006).

A total of 21 cross sections along the Kern River for Alternative A and 20 each for Alternatives B and C were used in the analysis. The plans and elevations for the bridges in the three alternatives were taken from the Advanced Planning Studies. The plans and profiles for these bridges are provided in Section 1 of this technical study. Cross sections at the bridge crossings were cut parallel to the proposed structures at the upstream and downstream faces of the proposed bridges. Piers and abutments were aligned parallel to the flow of the Kern River, and the upstream and downstream cross sections were offset to accommodate the various skew angles of the alternative bridges. The locations of the various cross sections within the vicinity of the proposed improvements are provided in Figures 3-2, 3-3, and 3-4 for Alternatives A, B, and C, respectively.

Manning's n values are used in the hydraulic model to estimate frictional energy losses in the flow. A Manning's n value of 0.039 was used for the main channel. For the left and right overbanks, a Manning's n value of 0.065 was used. The Manning's n values were selected based on an iterative process of calibrating the calculated design water surface to the Flood Insurance Study flood profiles (WRECO 2008). The values selected appear to conservatively estimate the roughness and frictional losses expected from the existing and proposed channel characteristics with the design storm condition (100-year storm event).

3.1.1.2 Water Surface Elevations

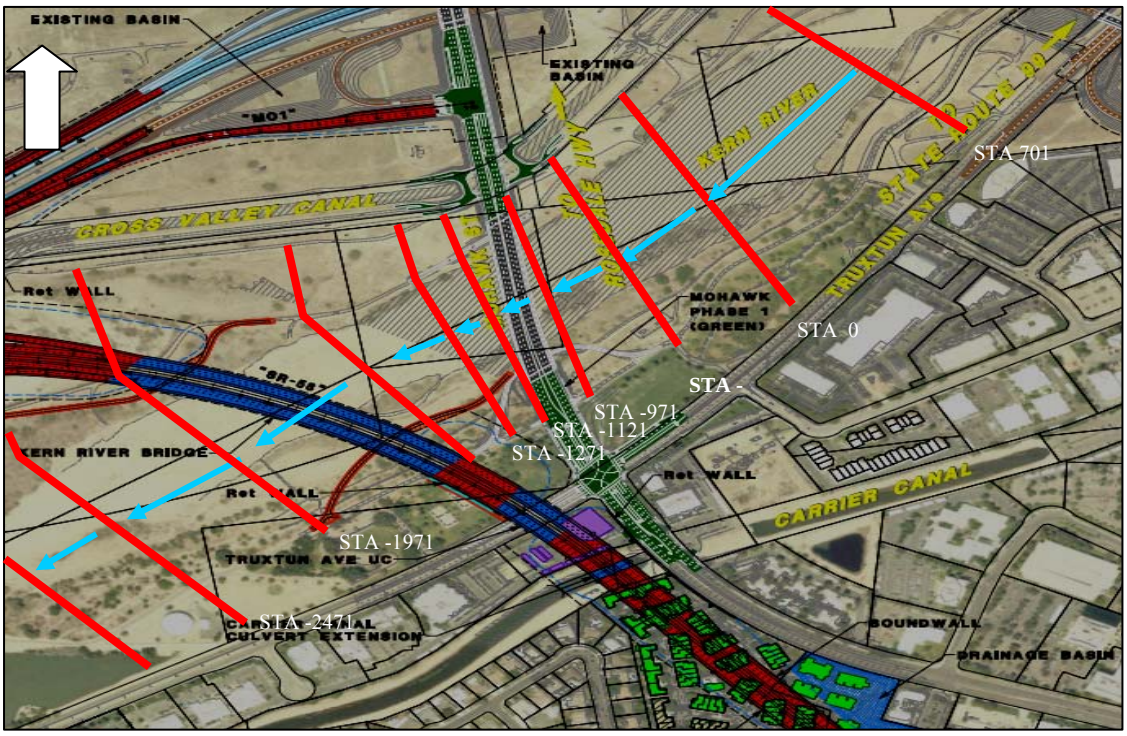
The water surface elevations for existing conditions and proposed bridge alternatives are summarized in Table 3-1. The table shows water surface elevations at the cross sections used in the HEC-RAS model, located both upstream and downstream of the proposed bridges. The model results indicate a change in water surface elevation for Alternatives A, B, and C. Alternative A results in the greatest change in water surface, with a maximum increase of 0.46-foot or approximately 5.5 inches at River Station -1271. The change is reduced to zero approximately 3,600 feet upstream of the proposed bridge for Alternative A. Alternatives B and C result in a maximum water surface increase of 0.15-foot, or approximately 1.8 inch, at River Station 1812, causing increases in water surface elevation for a distance of approximately 1,500 feet. See Appendix D (Profiles and Cross Sections from HEC-RAS Modeling) and Appendix E (HEC-RAS Modeling Results) for cross sections at the upstream and downstream edges of the proposed bridges and their respective ramps, as well as water surface elevations and other hydraulic data at each cross section in tabular format.



Note: Zone AE = areas that are subject to flooding by the 100-year flood event, and base flood elevations are shown; Zone X = areas protected from the 100-year flood event by levees that prevent overtopping of adjacent flood channels

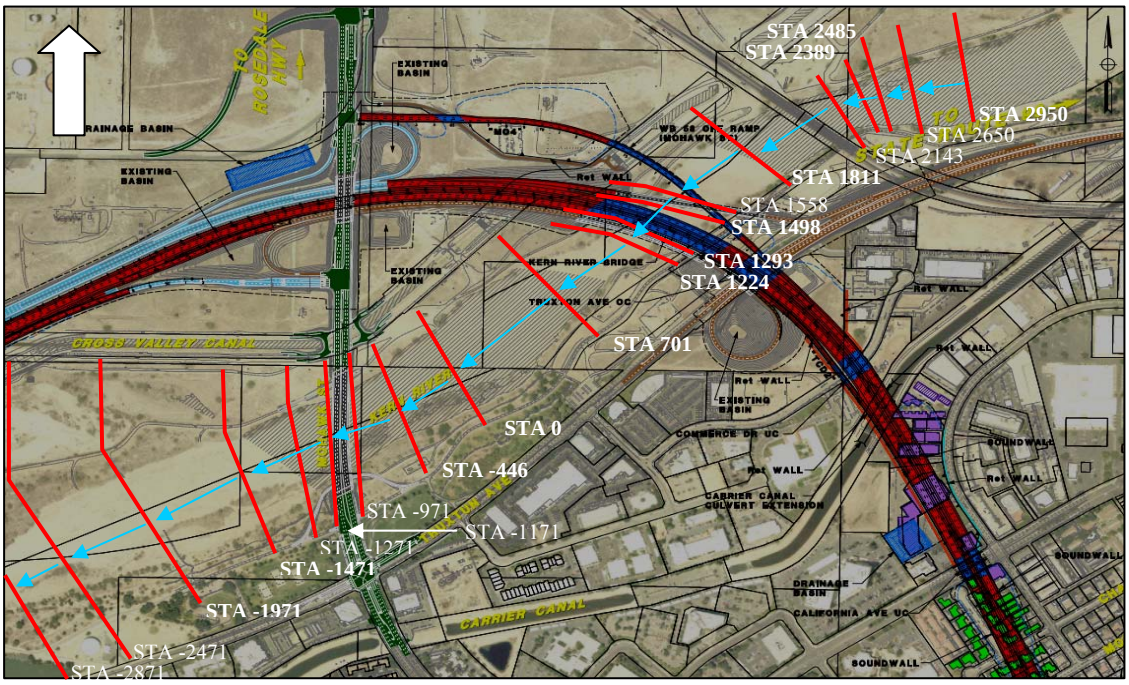
Source: Google Earth and FEMA

Figure 3-1 100-Year Floodplain Map



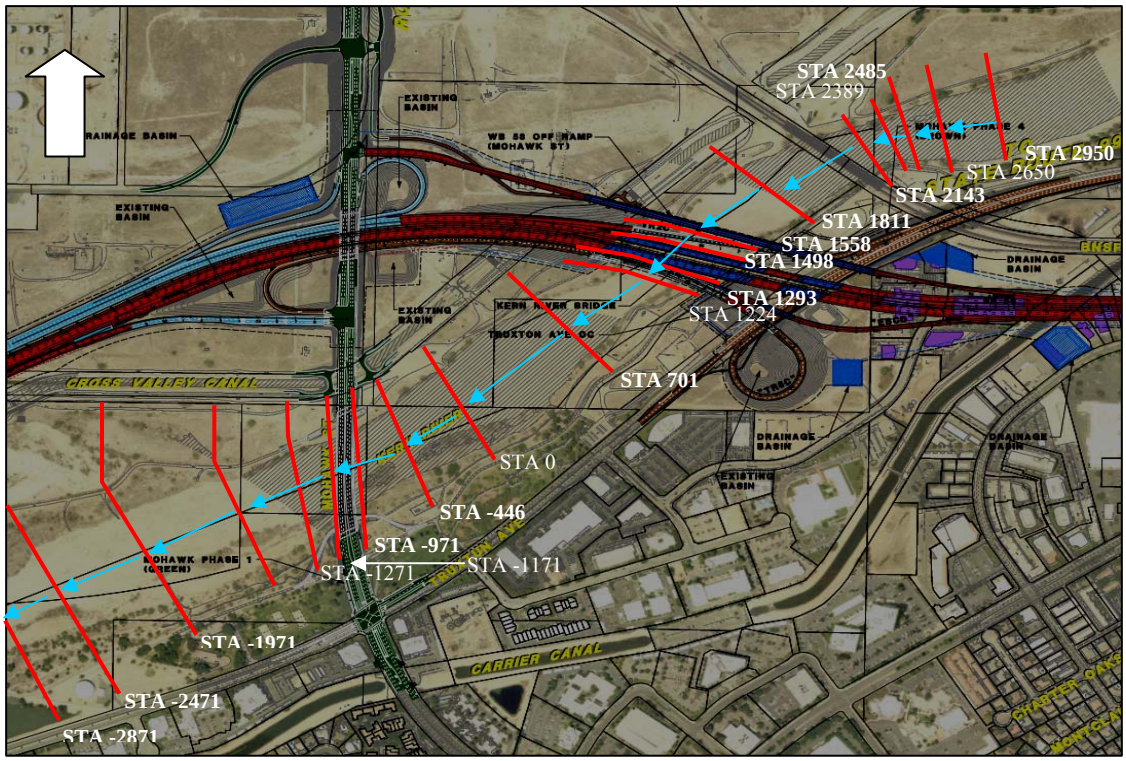
Note: Cross section locations are shown as red lines perpendicular to blue directional flow arrows.

Figure 3-2 Cross Sections at Proposed Bridge (Alternative A)



Note: Cross section locations are shown as red lines perpendicular to blue directional flow arrows.

Figure 3-3 Cross Sections at Proposed Bridges (Alternative B)



Note: Cross section locations are shown as red lines perpendicular to blue directional flow arrows.

Figure 3-4 Cross Sections at Proposed Bridges (Alternative C)

Table 3-1 Water Surface Elevations and Levee Freeboard

Station	Water Surface Elevation (100-Yr)				Change in Water Surface			Levee Elevation		Existing Levee Freeboard		Levee Freeboard with Improvements (Minimum)	
	Existing (ft)	Alt A (ft)	Alt B (ft)	Alt C (ft)	Alt A (ft)	Alt B (ft)	Alt C (ft)	Left (ft)	Right (ft)	Left (ft)	Right (ft)	Left (ft)	Right (ft)
2950	395.1	395.12	395.17	395.2	0.07	0.07	0.1	402.29	400.45	8.9	7.1	8.8	7
2650	394.67	394.69	394.75	394.79	0.08	0.08	0.12	402.17	399	9.1	6	9	5.9
2485	394.63	394.65	394.71	394.75	0.08	0.08	0.12	402.14	398.84	9.2	5.9	9.1	5.8
2389	394.62	394.63	394.70	394.73	0.08	0.08	0.11	402.77	400.98	9.8	8	9.7	7.9
2143	394.46	394.47	394.54	394.58	0.08	0.08	0.12	399.82	398.66	7	5.8	6.9	5.7
1812	393.84	393.91	393.99	393.99	0.15	0.15	0.15	399.30	397.20	7	4.9	6.9	4.8
Westbound Off-Ramp to Mohawk (Alternatives B and C)													
1558	393.59	393.7	393.71	393.69	0.11	0.12	0.1	399.28	398.04	7.2	5.9	7.1	5.8
1498	393.48	393.58	393.60	393.57	0.1	0.12	0.09	398.90	397.10	6.9	5.1	6.8	5
Centennial Corridor (Alternatives B and C)													
1224	392.47	392.64	392.47	392.47	0.17	0	0	398.63	395.20	7.3	3.9	7.1	3.7
701	391.91	392.14	391.91	391.91	0.23	0	0	397.83	397.41	7	6.6	6.8	6.4
0	391.43	391.72	391.43	391.43	0.29	0	0	395.88	396	5.4	5.5	5.1	5.2
-446	391.12	391.45	391.12	391.12	0.33	0	0	396.26	396.08	6	5.8	5.7	5.5
-971	390.75	391.12	390.75	390.75	0.37	0	0	396.04	396.02	6	6	5.6	5.6
-1121	390.32	390.74	390.32	390.32	0.42	0	0	396.38	395.16	6.6	5.4	6.2	5.0
-1271	390.17	390.63	390.17	390.17	0.46	0	0	395.62	394.86	5.9	5.2	5.4	4.7
-1471	390	390.35	390	390	0.35	0	0	395.64	394.46	6.1	4.9	5.7	4.5
Centennial Corridor (Alternative A)													
-1971	389.68	389.69	389.68	389.68	0.01	0	0	394.67	393.46	5.3	4	5.3	4
-2471	389.38	389.38	389.38	389.38	0	0	0	394.14	393.19	4.9	3.9	4.9	3.9
-2871	389.17	389.17	389.17	389.17	0	0	0	393.62	392.63	4.5	3.5	4.5	3.5

3.1.1.3 Impacts to Levees

Levees run along both sides of the Kern River at the project site. The Cross Valley Canal runs parallel to the Kern River along the project reach. These levees help to protect Bakersfield from potential flood hazards. The city participates in the National Flood Insurance Program, which is administered by the Federal Emergency Management Agency. The National Flood Insurance Program-mandated freeboard criteria for levees to be recognized as flood protection features are as follows: (1) levees must pass the Federal Emergency Management Agency base flood with a minimum of 3-feet of freeboard, and (2) within 100 feet of structures (such as bridges), the levee must protect an additional 1-foot of freeboard above the base flood elevation. Based on the hydraulic analyses, the Kern River levees for Alternatives A, B, and C have more than the mandated freeboard for the 100-year design flow. Available freeboard at the levees is listed in Table 3-1.

3.1.1.4 Bridge Alternatives Summary

Although considered, the bridge crossing for Alternative A produced the greatest increase in water surface elevation within the floodplain, without encroaching upon mandated freeboard of the river's levees. The bridge and associated ramp crossing for Alternatives B and C produced smaller increases in water surface elevation along the studied length of the Kern River. Freeboard along both levees was not greatly affected.

3.1.2 Project Evaluation

Three alternative bridge scenarios are proposed along the Kern River, all with abutments and piers within the 100-year floodplain. While each alternative bridge does encroach upon the floodplain, impacts to the floodplain remain insignificant. The Federal Highway Administration defines a "significant encroachment" as a highway encroachment, and any direct support of likely base floodplain development, that would involve one or more of the following construction or flood-related impacts: (1) significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route; (2) a significant risk; or (3) a significant adverse impact on the natural and beneficial floodplain values (FHWA 1994). Each criterion is evaluated separately below.

3.1.2.1 Risk Associated with Implementation of the Action

The effects of the proposed bridges on the floodplain were evaluated for the three alternatives using the U.S. Army Corps of Engineer's HEC-RAS modeling software (Version 4.1). Hydraulic analyses were performed for the base condition and for the three alternative conditions.

The downstream boundary condition for the flood simulation model was set to the 100-year water surface elevation presented in the Federal Emergency Management Agency Flood Insurance Study for the Kern River and is adopted from the previous Mohawk Bridge hydraulics study. The estimated water surface elevations for the base condition were compared with the water surface elevations for the three alternatives. For each alternative, the results from this analysis indicated that changes would occur in the water surface elevations and velocities in the vicinity of the proposed bridge crossing. Alternative A would result in the greatest difference in elevation (see Table 3-1). Even though the increases in water surface will not encroach on the mandated levee freeboard, the CVFPB must still be consulted regarding the potential water surface increase during the final design phase of the project. The CVFPB may require incorporation of additional measures for minimizing or avoiding water level changes.

Because the piers and abutments for the bridges (for the three alternatives) would encroach upon the 100-year floodplain, the project would decrease the channel opening of the floodplain. The decrease in channel opening for the floodplain would result in an increase in water surface elevation, with Alternative A having the most impact as indicated above. The project would also increase the runoff from the impervious surfaces, but the runoff would be conveyed to retention basins instead of the river. Therefore, the risks to the river's floodplain due to the added impervious surfaces would be eliminated.

3.1.2.2 Impacts on Natural and Beneficial Floodplain Values

Natural and beneficial floodplain values include, but are not limited to, fish, wildlife foraging, migration, and breeding; flood flow conveyance and storage; groundwater recharge; and recreational activities. Even with surrounding urbanization, the Kern River channel and adjacent floodplain have moderate wildlife habitat values.

Beneficial uses of the Kern River, as stated in the Water Quality Control Plan for the Tulare Lake Basin (RWQCB 2004), are listed in Table 3-2.

Habitat loss with implementation of any build alternative would not alter the beneficial use of the floodplain by wildlife. This is because the amount to be removed is minimal, with a maximum of .01 acre permanent wetland loss for Alternative C and no loss for Alternatives A and B. Permanent loss of up to 0.13 acre non-wetland Waters of the United States with Alternative A (0 for the other alternatives) would not be considered critical to the survival of populations of species inhabiting the area. For more discussion of this topic, see the Floodplain Evaluation Report for Segment 1 (Caltrans 2011b).

Table 3-2 Beneficial Uses for the Kern River (Below KR-1)

MUN	Municipal and Domestic Supply — Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.
AGR	Agricultural Supply — Uses of water for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
IND	Industrial Service Supply — Uses of water for industrial activities that do not depend primarily on water quality, including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.
PRO	Industrial Process Supply — Uses of water for industrial activities that depend primarily on water quality.
POW	Hydropower Generation — Uses of water for hydropower generation.
REC-1	Water Contact Recreation — Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.
REC-2	Non-Contact Water Recreation — Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
WARM	Warm Freshwater Habitat — Uses of water that support warm water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. WARM includes support for reproduction and early development of warm water fish.
WILD	Wildlife Habitat — Uses of water that support terrestrial or wetland ecosystems, including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
RARE	Rare, Threatened, or Endangered Species — Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.
GWR	Ground Water Recharge — Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Source: Central Valley RWQCB.

3.1.2.3 Support of Probable Incompatible Floodplain Development

As defined by the Federal Highway Administration, the support of incompatible base floodplain development could "encourage, allow, serve, or otherwise facilitate" development, such as commercial uses; however, the Centennial Corridor Project would not support any incompatible floodplain development because it would not provide any new permanent access to the Kern River floodplain.

Any one of the three alternative bridges would enhance connectivity between downtown Bakersfield and the west side of the Bakersfield metropolitan area.

3.1.2.4 Measures to Minimize Floodplain Impacts Associated with the Action

As stated in Section 3.1.2.1, the project would decrease the channel opening of the floodplain. Areas filled by the project's construction could be mitigated with

excavation of additional storage area equal in volume to the increased occupied floodplain volume. Flows within the Kern River watershed should be restored following the completion of construction. Materials that were used to maintain flow and divert water from the project area during the construction window, including, but not limited to, cofferdams, pipes, filter fabric, fill material, and gravel, should be removed. Other measures to minimize flood flow impacts include:

- Incorporation of bridge piers and abutments paralleling the direction of flow to minimize flow obstruction;
- Pier placement optimized to align the proposed piers with existing piers in the Kern River;
- Bridge abutments located outside of or as close to the limits of the floodplain as feasible to decrease the reduction of conveyance capacity of the Kern River;
- Bridges designed with sufficient freeboard above the 100-year flood water surface elevation to prevent the bridge deck from impacting flood flows; and
- Installation of culverts or other drainage facilities underneath alignment embankments, where required, to maintain existing storm water runoff patterns in the study area.

3.1.2.5 Measures to Restore and Preserve the Natural and Beneficial Floodplain Values Impacted by this Action

Measures to offset impacts to wetlands would be identified in the Section 404 permit for the project, which would be secured before starting construction. The identified potential impacts on the natural and beneficial floodplain values include:

- Temporary loss of vegetation from clearing of the channel for construction;
- Potential effects on endangered species or their habitats (within the project site) during maintenance and management activities; and
- The potential removal of bank aquatic habitats during the removal of accumulated debris.

Environmental impacts that would be a result of construction activities could be minimized with measures such as revegetation, best management practices, or other requirements anticipated as part of the project permit conditions. Caltrans would obtain, as necessary, permits or approvals from the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, California Department of Fish and Game, Regional Water Quality Control Board, and Federal Emergency Management Agency.

3.1.2.6 Practicability of Alternatives to any Significant Encroachments

As defined by the Federal Highway Administration, risk shall mean the consequences associated with the probability of flooding attributable to an encroachment. It shall include the potential for property loss and hazard to life during the service life of the bridge and roadway.

Three build alternatives were considered for this study. Based on results of the preliminary hydraulic analyses, the project would not significantly impact the floodplain. The water surface elevation would increase with construction of the bridge but not by a significant amount, as discussed in Section 3.1.

3.1.2.7 Practicability of Alternatives to any Longitudinal Encroachments

As defined by the Federal Highway Administration, a longitudinal encroachment is an action within the limits of the base floodplain that is longitudinal to the normal direction of the floodplain.

A longitudinal encroachment is "[a]n encroachment that is parallel to the direction of flow. Example: A highway that runs along the edge of a river is, usually considered a longitudinal encroachment." The requirement for consideration of avoidance alternatives in a Location Hydraulic Study is fulfilled by including an evaluation and a discussion of the practicability of alternatives to any significant encroachment or any support of incompatible floodplain development.

The project would be constructed roughly perpendicular to the direction of flow of the Kern River. Longitudinal encroachments due to the project are not anticipated near the river crossings; therefore, alternatives were not considered. However, a portion of the roadway would encroach longitudinally onto the floodplain west of the proposed bridge crossings and between the Friant-Kern Canal and Mohawk Street. This area was previously studied for the Westside Parkway Project (URS 2006). The Location Hydraulic Study for that project indicated that the longitudinal encroachment "takes place in the overflow area of the 100-year floodplain" and that the hydraulic analysis indicated a increase in water surface elevation at that location. The hydraulic analyses for this study similarly indicate a increase in water surface elevation. The farthest downstream cross section in the model corresponds to the beginning of this longitudinal encroachment. See Section 3.1 for the water surface elevations.

3.1.2.8 Coordination with Local, State, and Federal Water Resources and Floodplain Management Agencies

The project crosses the Kern River, which is a designated regulatory floodway. The Federal Emergency Management Agency should review this report to determine if a floodplain map revision would be necessary. A Conditional Letter of Map Revision is not anticipated because the increase in base flood elevation would be negligible. Coordination would occur during the plans, specifications, and estimate phase of project development. Regulatory permitting would also be required; hence, coordination with resource agencies would occur during the plans, specifications, and estimate phase of project development.

3.2 Summary

Caltrans is proposing to construct the Centennial Corridor as an east-west transportation corridor between SR 58/SR 99 in the Bakersfield Metropolitan area and I-5 in western Kern County. Currently, there is not a direct connection between SR 99 in Bakersfield and I-5 to the west. The proposed project would connect these two highways and increase regional mobility in Kern County and the Bakersfield area.

The purpose of this report is to document the impacts to the Kern River floodplain resulting from the proposed project. This report focuses on three proposed build alternatives (Alternatives A, B, and C) for the bridge structure crossing over the Kern River.

For all build alternatives, the bridge would be constructed over the Kern River within a flood zone that is subject to inundation from the 100-year flood, as determined by the Federal Emergency Management Agency.

Floodplain impacts from the project would be due to construction of the bridge's piers and abutments, resulting in a decrease in channel opening. There would also be an increase in impervious area equal to the surface area taken up by the proposed road; however, the additional amount of impervious area would be significantly less than the overall watershed area of the Kern River. Based on preliminary calculations, it was determined that the bridge would have no significant effect on the water surface elevation and velocities.

The project's impact to the levees, which are on both sides of the Kern River, was also assessed. The freeboard criteria for levees requires that the levees pass the Federal Emergency Management Agency base flood with a minimum of 3-feet of

freeboard, and that within 100 feet of structures (such as bridges), the levees must provide an additional 1-foot of freeboard above the base flood elevation. Based on the hydraulic model results, Alternatives A, B, and C would not adversely affect the available freeboard beyond existing conditions.

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Appendix A Summaries of Floodplain Encroachment

SUMMARY FLOODPLAIN ENCROACHMENT REPORT – Alternative A Bridge

District: 6 County: Kern Route: Centennial Corridor
Project No.: 06-0000-0484 Bridge No.: 50-XXXX
Limits: The floodplain encroachment was assessed for the Kern River between the two levees, which are on both sides of the river.

Floodplain Description: The Project area is susceptible to flooding from the 100-year base floodplain and is located in a regulated floodway. The proposed bridge would increase the water surface elevation as described in this report.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	☒	☐
2.	Are the risks associated with the implementation of the proposed action significant?	☒	☐
3.	Will the proposed action support probable incompatible floodplain development?	☒	☐
4.	Are there any significant impacts on natural and beneficial floodplain values?	☒	☐
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	☒	☐
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	☒	☐
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.	☐	☒

PREPARED BY:

_____

Signature - Hydraulic Engineer Date

CONCURRENCE FROM:

_____

Signature - Dist. Hydraulic Engineer Date

_____

Signature - Dist. Environmental Branch Chief Date

_____

Signature - Dist. Project Engineer Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT – Alternative B Bridge

District: 6 County: Kern Route: Centennial Corridor
Project No.: 06-0000-0484 Bridge No.: 50-XXXX
Limits: The floodplain encroachment was assessed for the Kern River between the two levees, which are on both sides of the river.

Floodplain Description: The Project area is susceptible to flooding from the 100-year base floodplain and is located in a regulated floodway. The proposed bridge would increase the water surface elevation as described in this report.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	☒	☐
2.	Are the risks associated with the implementation of the proposed action significant?	☒	☐
3.	Will the proposed action support probable incompatible floodplain development?	☒	☐
4.	Are there any significant impacts on natural and beneficial floodplain values?	☒	☐
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	☒	☐
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	☒	☐
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.	☐	☒

PREPARED BY:

_____

Signature - Hydraulic Engineer Date

CONCURRENCE FROM:

_____

Signature - Dist. Hydraulic Engineer Date

_____

Signature - Dist. Environmental Branch Chief Date

_____

Signature - Dist. Project Engineer Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT – Alternative C Bridge

District: 6 County: Kern Route: Centennial Corridor
Project No.: 06-0000-0484 Bridge No.: 50-XXXX
Limits: The floodplain encroachment was assessed for the Kern River between the two levees, which are on both sides of the river.

Floodplain Description: The Project area is susceptible to flooding from the 100-year base floodplain and is located in a regulated floodway. The proposed bridge would increase the water surface elevation as described in this report.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	☒	☐
2.	Are the risks associated with the implementation of the proposed action significant?	☒	☐
3.	Will the proposed action support probable incompatible floodplain development?	☒	☐
4.	Are there any significant impacts on natural and beneficial floodplain values?	☒	☐
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	☒	☐
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	☒	☐
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.	☐	☒

PREPARED BY:

_____

Signature - Hydraulic Engineer Date

CONCURRENCE FROM:

_____

Signature - Dist. Hydraulic Engineer Date

_____

Signature - Dist. Environmental Branch Chief Date

_____

Signature - Dist. Project Engineer Date

Technical Information for Location Hydraulic Study

Dist. 06 Co. Kern Rte. SR 58 and SR 99 K.P. PM31.7 to 55.6 for 58, and PM21.2 to 26.2 for 99
EA 06-48460K Bridge Number 50-XXXX

Floodplain Description:

Project area is susceptible to flooding from the 100-year base floodplain and is located within a regulated floodway. The proposed bridge would increase the water surface elevation as described in this report.

1. Description of Proposal (include any physical barriers [i.e., concrete barriers, soundwalls, etc.] and design elements to minimize floodplain impacts)
   To alleviate the traffic congestion and improve regional and interregional connectivity, three build alternatives are proposed along new alignments to extend from the existing SR-58 (East) across the Kern River and connect to the east end of the Westside Parkway. Project design elements included in the report are: retention basins, optimized bridge pier placement, location of the bridge abutments outside of the floodplain, to extent feasible; and design the bridge deck with sufficient freeboard above 100' flood height. Project details are elaborated in the LHS report.

2. ADT: Current See attached Table Projected See attached

3. Hydraulic Data: Base Flood Q100= 15,000 cfs
   WSE100= LHS Appendix E The flood of record, if greater than Q100:
   Q= N/A WSE N/A
   Are NFIP maps available? Yes X No
   Are NFIP studies available? Yes X No

		Yes	No
4.	Is the highway location alternative within a regulatory floodway?	X	
5.	Attach map with flood limits outlined showing all building or other improvements within the base floodplain. Potential Q100 backwater damages:		
	A. Residences?		X
	B. Other Bldgs?		X
	C. Crops?		X
	D. Natural and beneficial Floodplain values?		X

Technical Information for Location Hydraulic Study

6. Type of Traffic:

A. Emergency supply or evacuation route?	X	
B. Emergency vehicle access?	X	
C. Practicable detour available	X	
D. School bus or mail route?	X	

7. Estimated duration of traffic interruption for 0 hours.
   100-year event
8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A. Roadway	$	0
B. Property	$	0
Total	$	0

9. Assessment of Level of Risk
   Low X Moderate _____ High _____
   For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible floodplain development?

No X Yes _____

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113.

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

PREPARED BY:

Signature – Hydraulic Engineer Date

CONCURRENCE FROM:

Signature - Dist. Hydraulic Engineer Date

Signature – Dist. Project Engineer Date

FLOODPLAIN EVALUATIONS REPORT SUMMARY

Dist. 06 Co. Kern Rte. SR 58 and SR 99 K.P. PM31.7 to 55.6 for 58, and PM21.2 to 26.2 for 99

Project No. 06-0000-0484 Bridge No. 50-XXXX

Limit: PM31.7 to 55.6 for 58, and PM21.2 to 26.2 for 99

Floodplain Description: The Project area is susceptible to flooding from the 100-year base floodplain and is located in a regulated floodway. The proposed bridge would increase the water surface elevation as described in this report.

	Yes	No
1. Is the proposed action a longitudinal encroachment of a floodplain?		X
2. Are the risks associated with the implementation of the proposed action significant?		X
3. Will the proposed action support probable incompatible floodplain development?		X
4. Are there any significant impacts on the natural and beneficial floodplain values?		X
5. Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain value? If yes, explain.		X
6. Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q)?		X
7. Are Location Hydraulic Studies that document the above answers on file? If not, explain.	X	

PREPARED BY:

Signature – Hydraulic Engineer Date

CONCURRENCE FROM:

Signature - Dist. Hydraulic Engineer Date

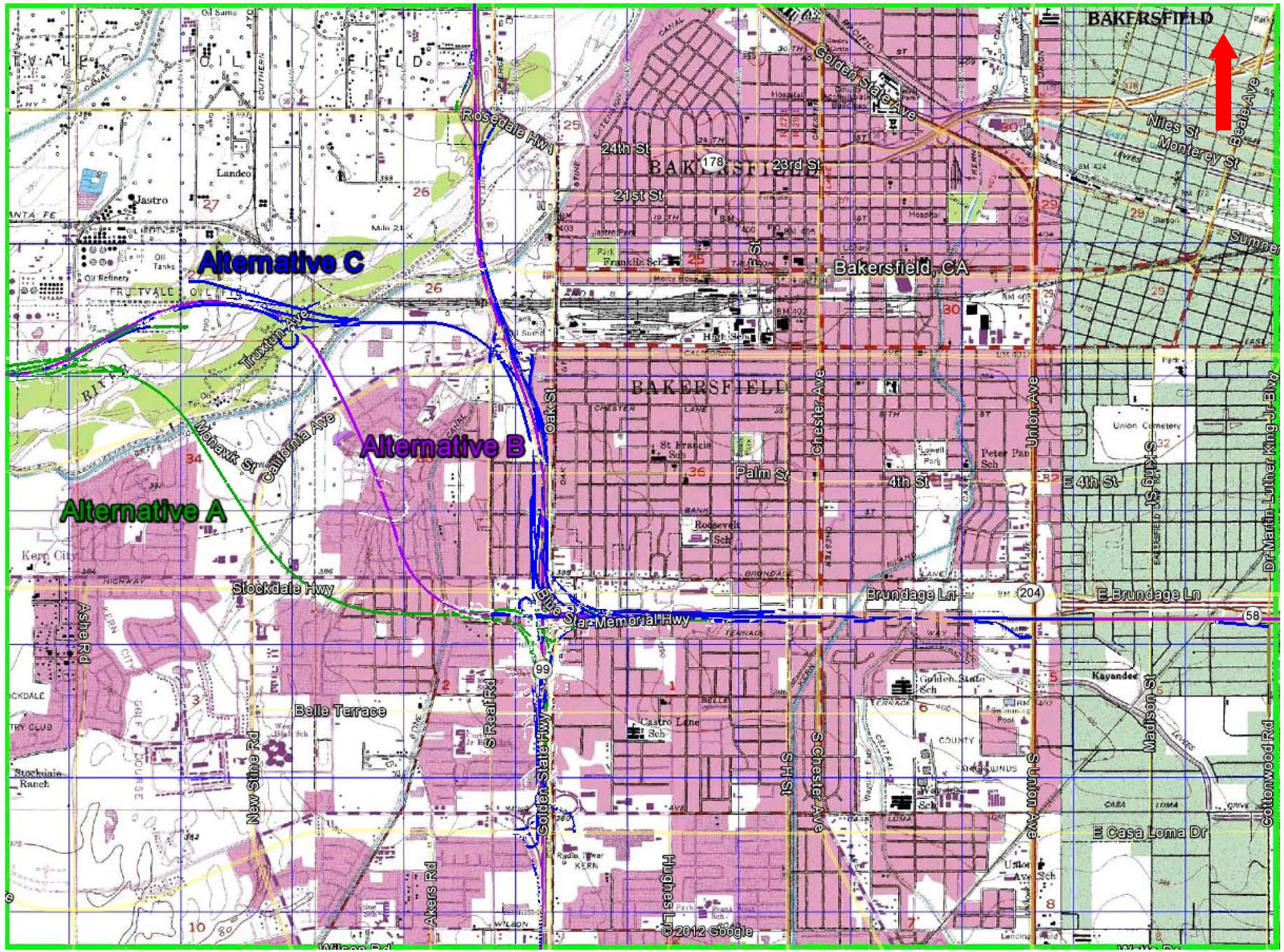
Signature – Dist. Project Engineer Date

Appendix ADT Summary Table

	Existing	Year 2038			
		No Build	Alt. A	Alt. B	Alt. C
SR-99 North Bound (C)	123,000	108,630	89,720	88,125	105,960
SR-99 South Bound (C)		111,845	93,990	90,920	N/A
SR-99 North Bound (E)	134,000	115,760	84,200	83,030	117,280
SR-99 South Bound (E)		108,490	88,655	88,615	N/A
SR-58 West Bound (M)	68,000	60,385	65,779	65,905	65,005
SR-58 East Bound (M)		62,198	62,430	78,840	72,065
SR-58 West Bound (K)	33,812	(J)52370	57,279	59,500	58,645
SR-58 East Bound (K)		(J)42605	56,410	61,875	59,760
	Year 2018				
	No Build	Alt. A	Alt. B	Alt. C	
SR-99 North Bound (C)	76,190	74,276	71,855	89,525	
SR-99 South Bound (C)	71,240	80,455	79,480	N/A	
SR-99 North Bound (E)	89,715	64,280	62,340	92,520	
SR-99 South Bound (E)	86,340	74,940	75,090	74,199	
SR-58 West Bound (M)	(L)47260	53,895	53,680	65,005	
SR-58 East Bound (M)	(L)48055	52,905	N/A	72,065	
SR-58 West Bound (J)	(I)34575	35,035	37,590	(K)58645	
SR-58 East Bound (J)	(I)34470	36,220	36,720	(K)59760	

*Data are obtained from the draft traffic report dated 11/08/2011. Letters refer to locations provided in the traffic report.

Appendix B 7.5 Minute Quadrangle Topographic Map



USGS 7.5 min USGS Topo Map
Gosford, CA

Map ID: 5101486

1:3000 ft

Appendix B Centennial Corridor Project Segment 1

Appendix C FEMA Flood Insurance Rate Maps

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole–foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC–3, #9202
1315 East–West Highway
Silver Spring, MD 20910–3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713–3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from USDA –Farm Service Agency –Aerial Photography Field Office dated 2005 and from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1992 or later.

This map reflects more detailed and up–to–date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

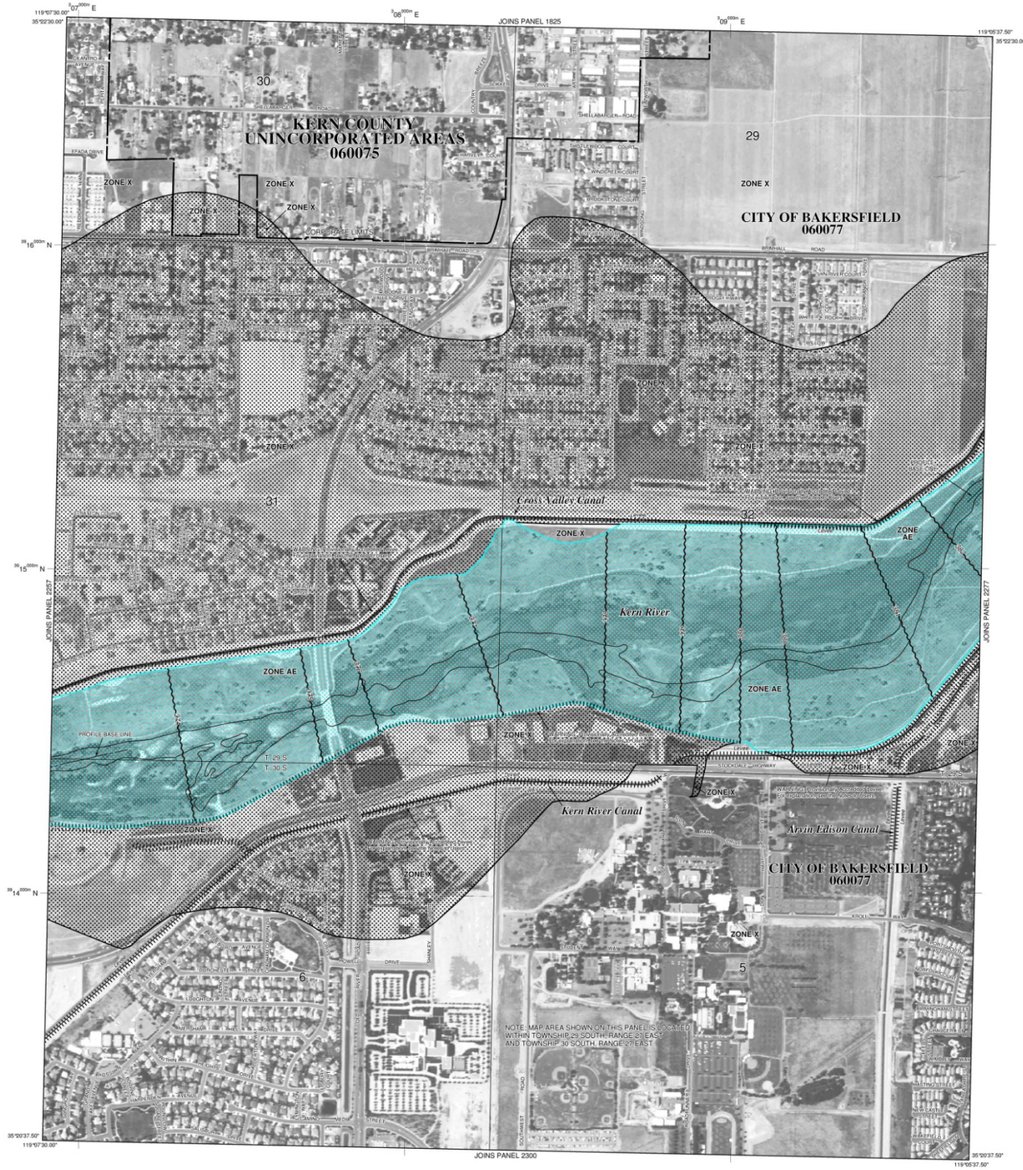
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de–annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1–800–358–9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1–800–358–9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1–877–FEMA MAP**(1–877–336–2627) or visit the FEMA website at http://www.fema.gov/.

WARNING: This levee, dike, or other structure has been provisionally accredited and mapped as providing protection from the 1-percent-annual-chance flood. To maintain accreditation, the levee owner or community is required to submit documentation necessary to comply with 44 CFR Section 65.10 by July 21, 2009. Because of the risk of overtopping or failure of the structure, communities should take proper precautions to protect lives and minimize damages in these areas, such as issuing an evacuation plan and encouraging property owners to purchase flood insurance.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 Base Flood Elevation line and value; elevation in feet*
- (EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A–A Cross section line
- 23–23 Transect line
- 97°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN 1000-meter Universal Transverse Mercator grid ticks, zone 11
- 6000000 M 5000-foot grid ticks: California State Plane coordinate system, V zone (FIPSZONE 0405), Lambert Conformal Conic
- DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2276E

FIRM
FLOOD INSURANCE RATE MAP
KERN COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 2276 OF 4125
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

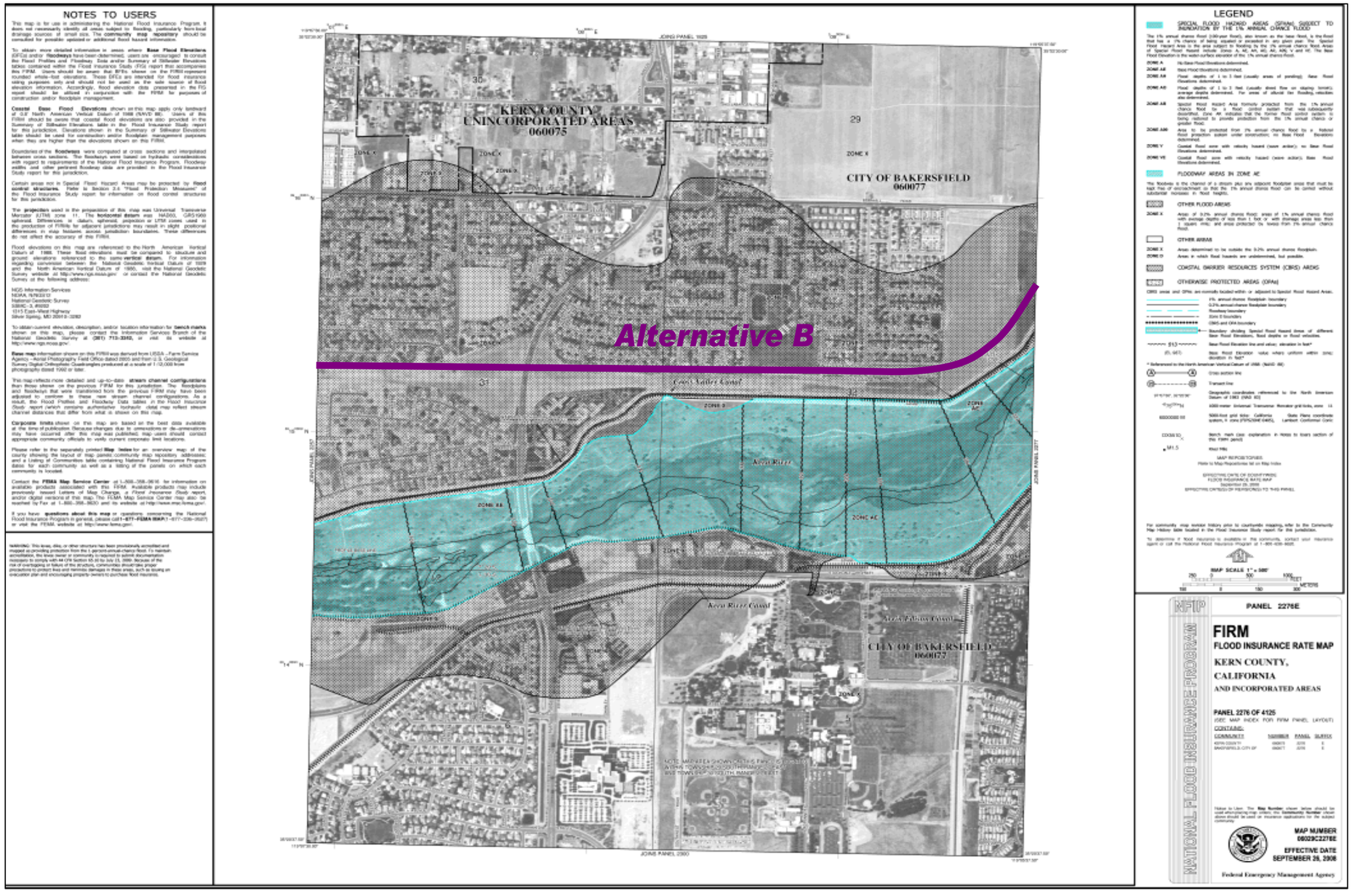
COMMUNITY	NUMBER	PANEL	SUFFIX
KERN COUNTY	060075	2276	E
BAKERSFIELD, CITY OF	060077	2276	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06029C2276E
EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

FIRM 06029C2276E



FIRM 06029C2276E with Alignments

NOTES TO USERS

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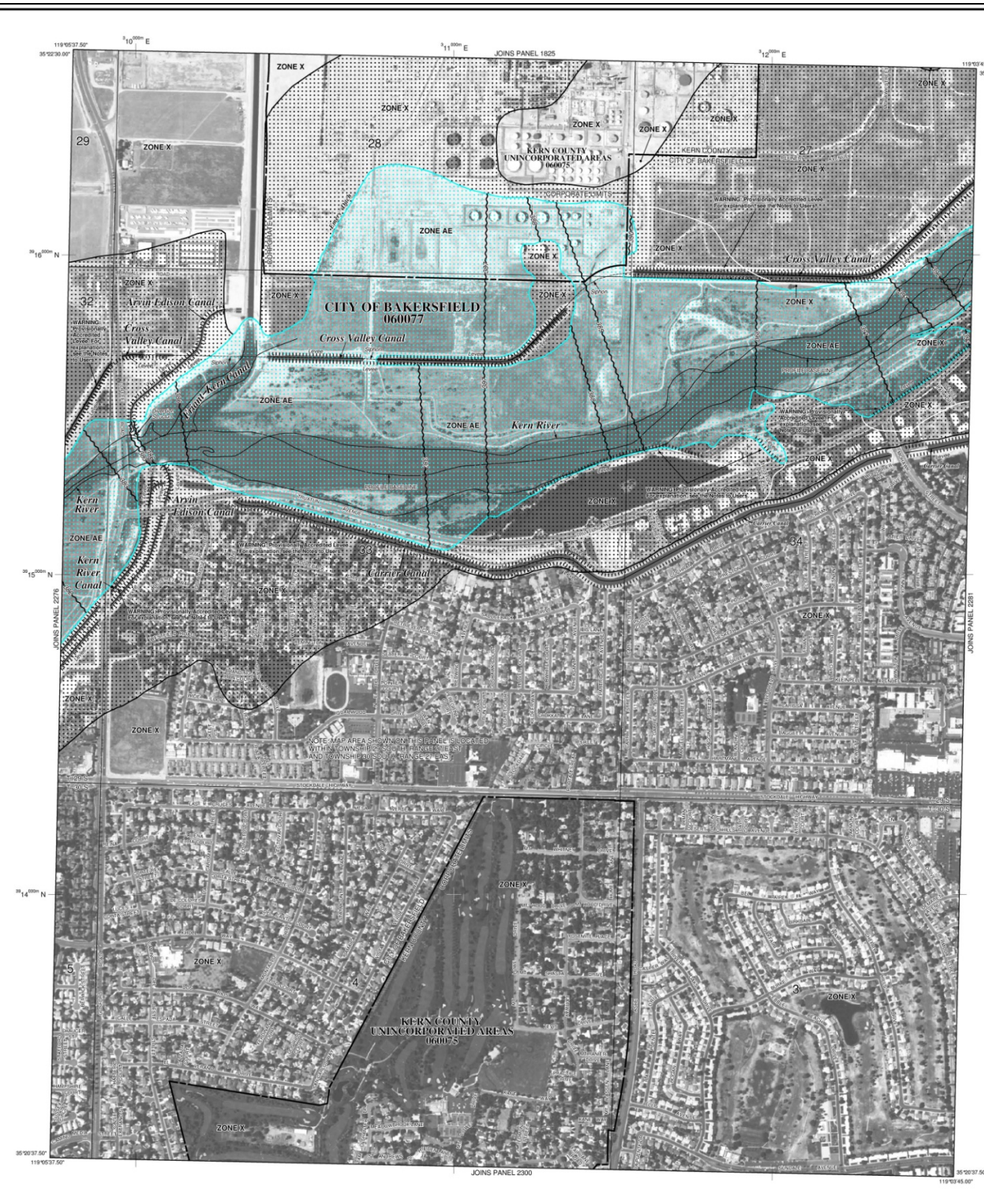

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- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
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- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
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- M1.5 — River Mile

MAP REPOSITORIES
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EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2277E

FIRM
FLOOD INSURANCE RATE MAP
KERN COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 2277 OF 4125
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

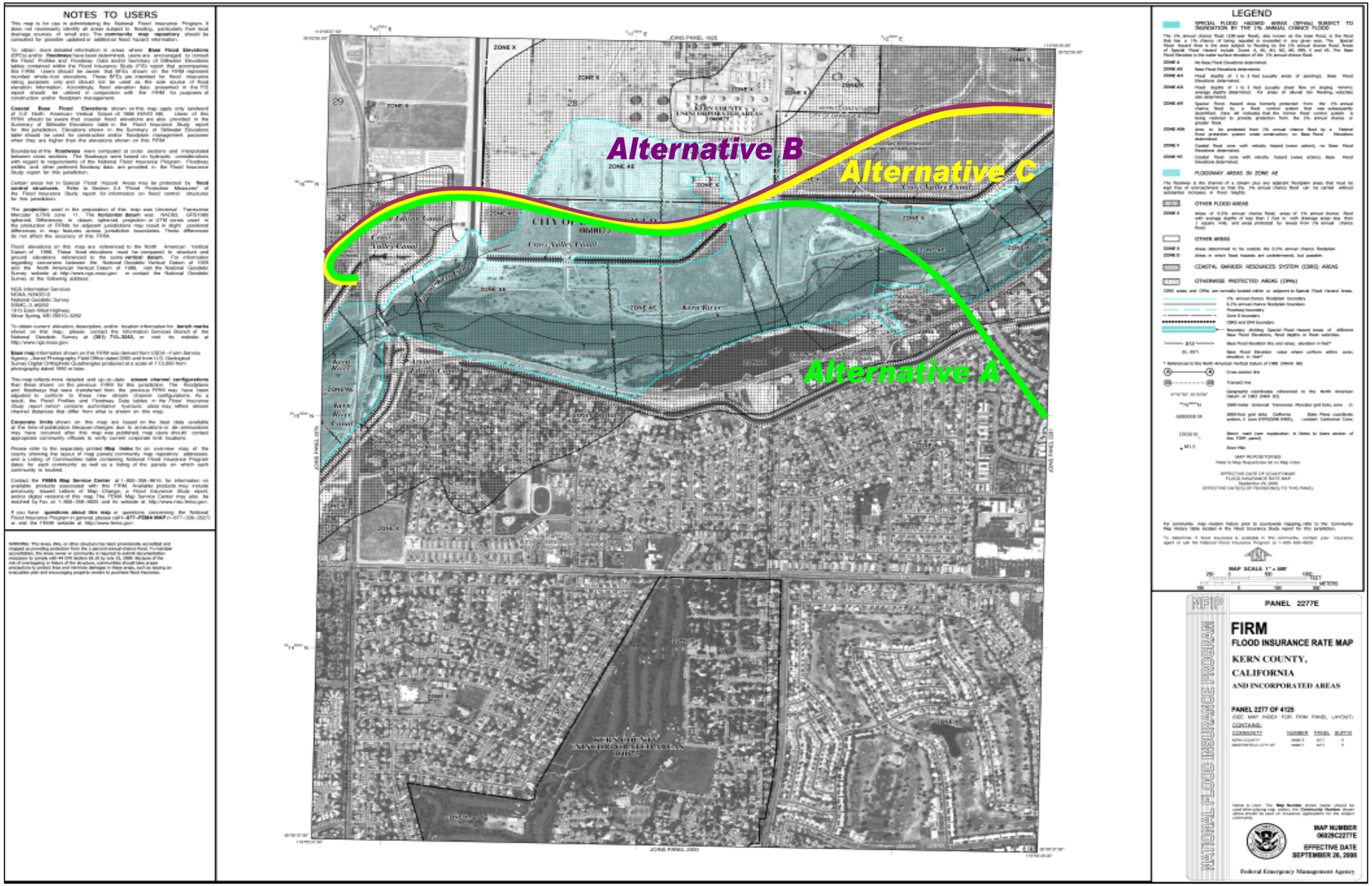
COMMUNITY	NUMBER	PANEL	SUFFIX
KERN COUNTY	060075	2277	E
BAKERSFIELD, CITY OF	060077	2277	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06029C2277E
EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

FIRM 06029C2277E



FIRM 06029C2277E with Alignments

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC–3, #9202
1315 East–West Highway
Silver Spring, MD 20910–3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713–3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from USDA –Farm Service Agency –Aerial Photography Field Office dated 2005 and from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1992 or later.

This map reflects more detailed and up–to–*date* **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de–annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1–800–358–9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1–800–358–9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1–877–FEMA MAP** (1–877–336–2627) or visit the FEMA website at http://www.fema.gov/.

WARNING: This levee, dike, or other structure has been provisionally accredited and mapped as providing protection from the 1-percent-annual-chance flood. To maintain accreditation, the levee owner or community is required to submit documentation necessary to comply with 44 CFR Section 65.10 by July 23, 2009. Because of the risk of overtopping or failure of the structure, communities should take proper precautions to protect lives and minimize damages in these areas, such as issuing an evacuation plan and encouraging property owners to purchase flood insurance.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equalled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 Base Flood Elevation line and value; elevation in feet*
- (EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A–A Cross section line
- 23–23 Transect line
- 97°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN 1000-meter Universal Transverse Mercator grid ticks, zone 11
- 6000000 M 5000-foot grid ticks: California State Plane coordinate system, V zone (FIPSZONE 0405), Lambert Conformal Conic
- DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

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MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2281E

FIRM
FLOOD INSURANCE RATE MAP
KERN COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 2281 OF 4125
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KERN COUNTY	060075	2281	E
BAKERSFIELD, CITY OF	060077	2281	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

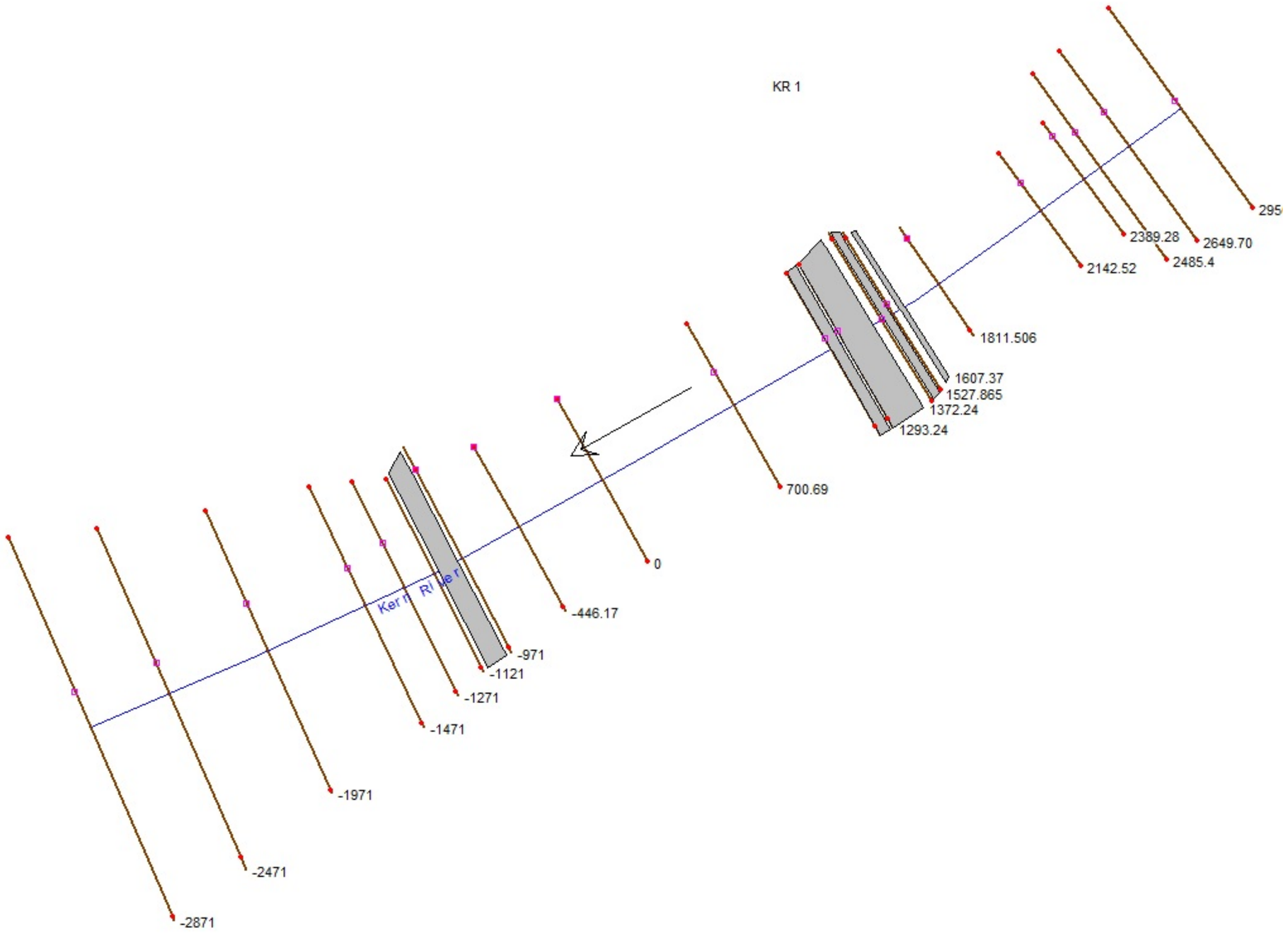
MAP NUMBER
06029C2281E
EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

FIRM 06029C2281E

FIRM 06029C2281E with Alignments

Appendix D Profiles and Cross Sections from HEC-RAS Modeling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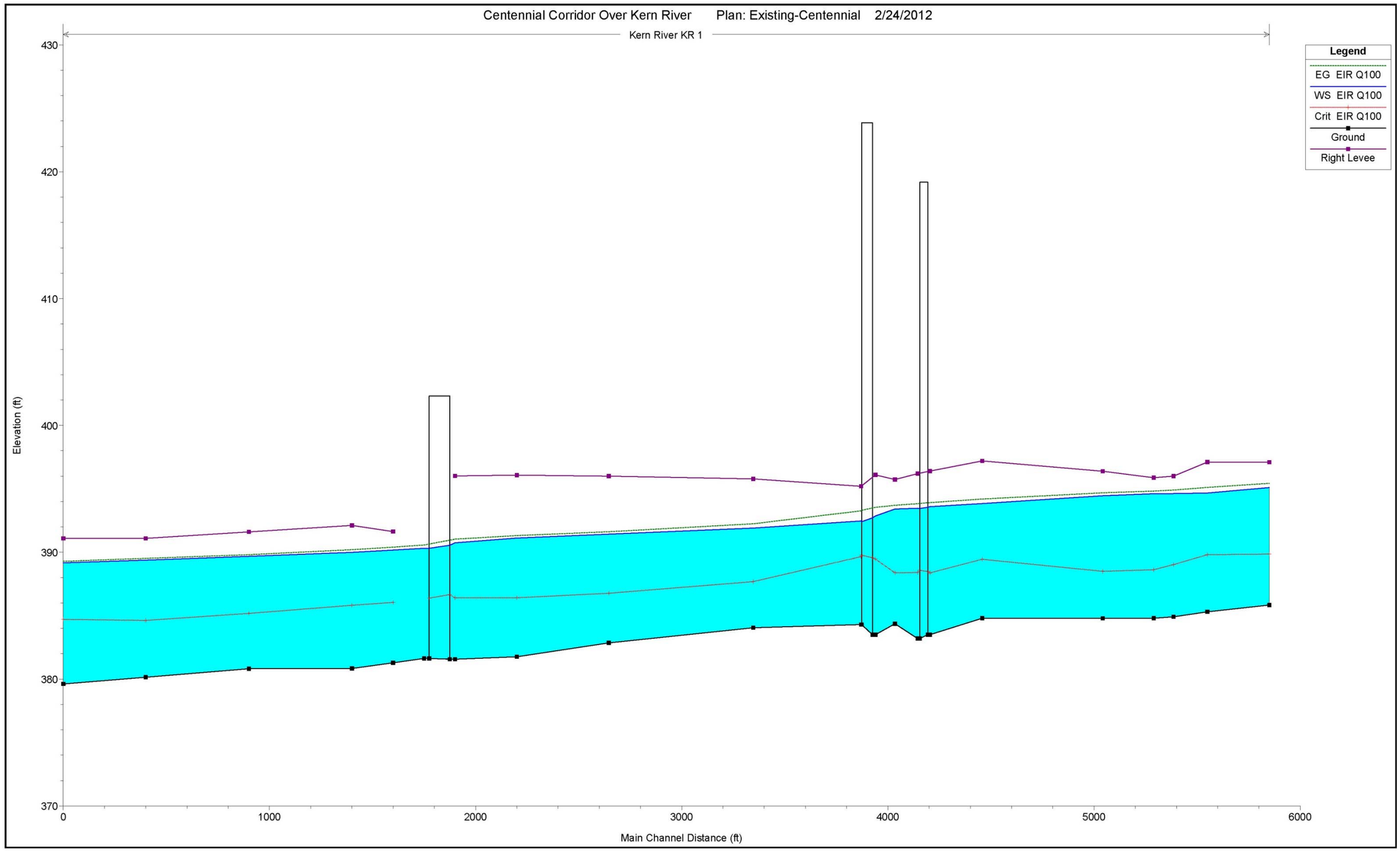
Kern River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Crit EIR Q100
Ground
Right Levee
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4000
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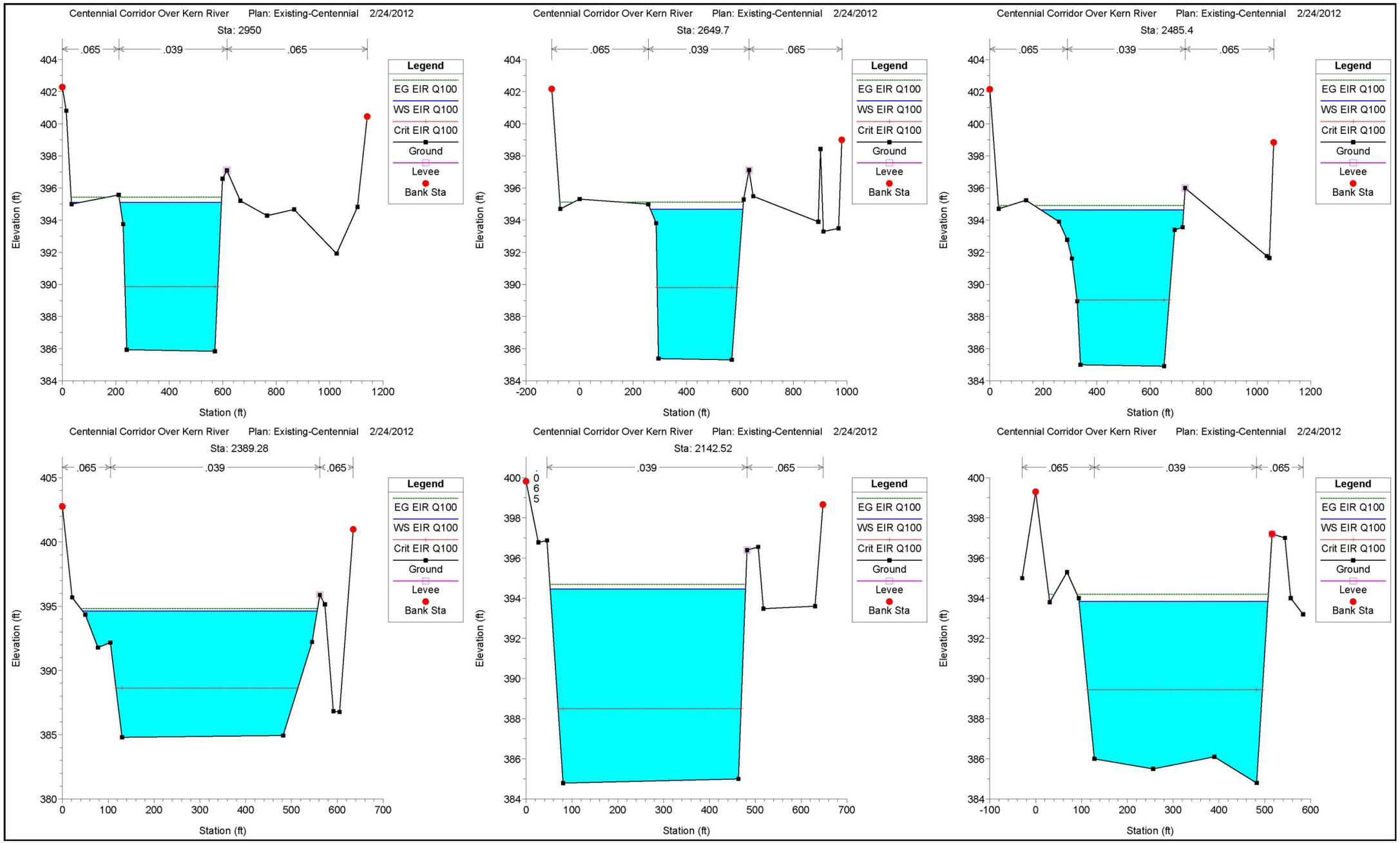
Main Channel Distance (ft)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Sta: 2485.4
Centennial Corridor Over Kern River Plan: Existing-Centennial 2/24/2012
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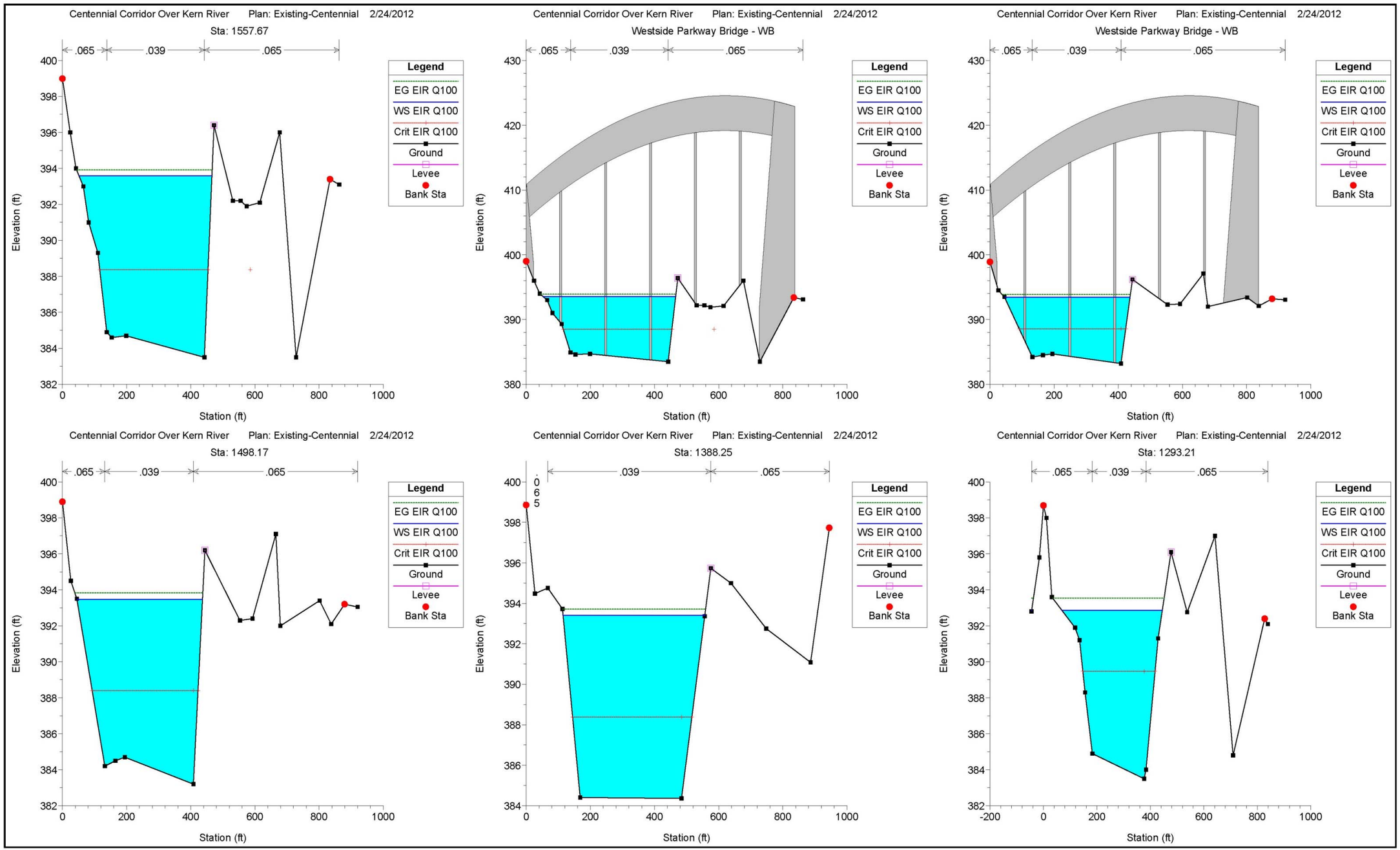
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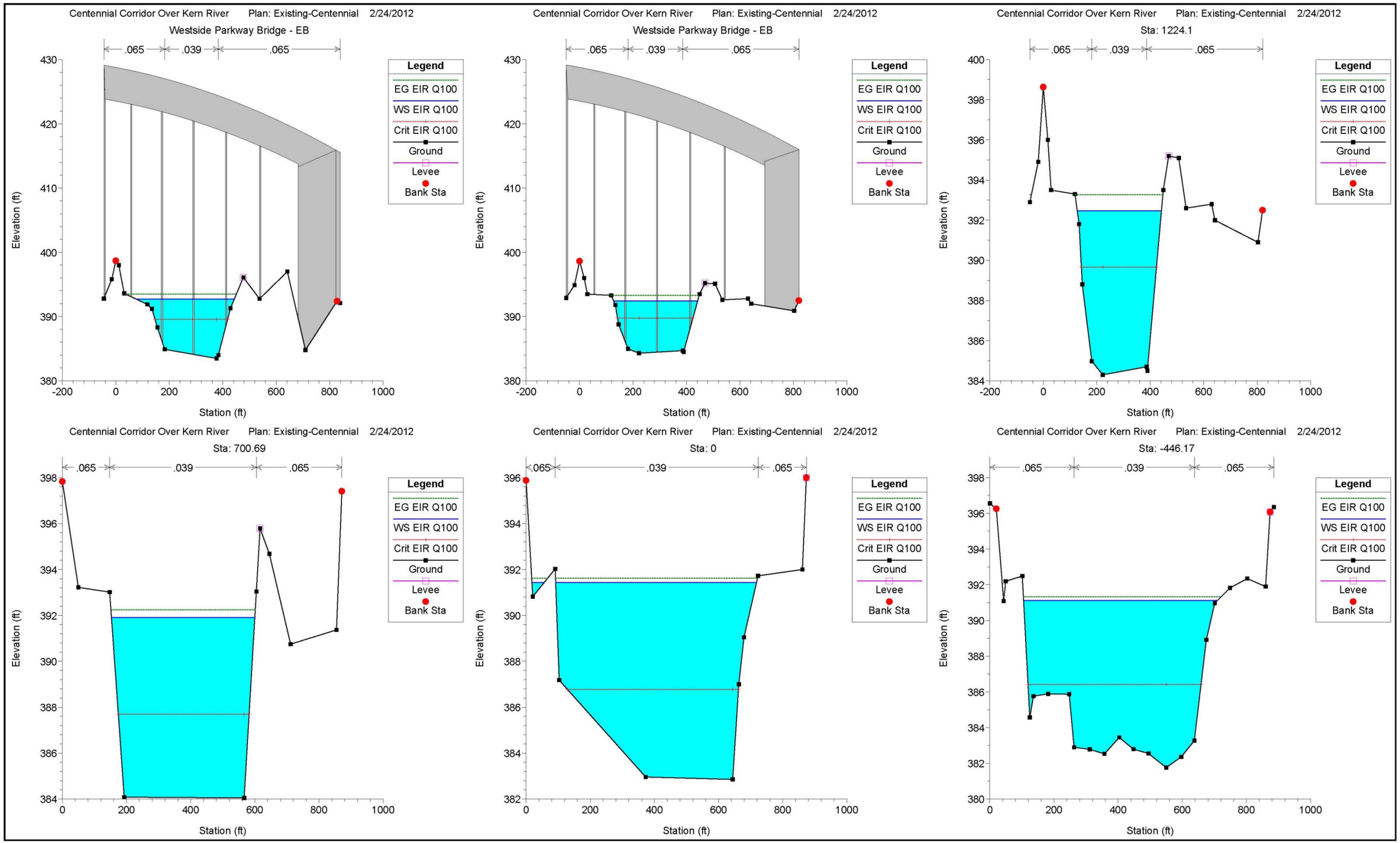
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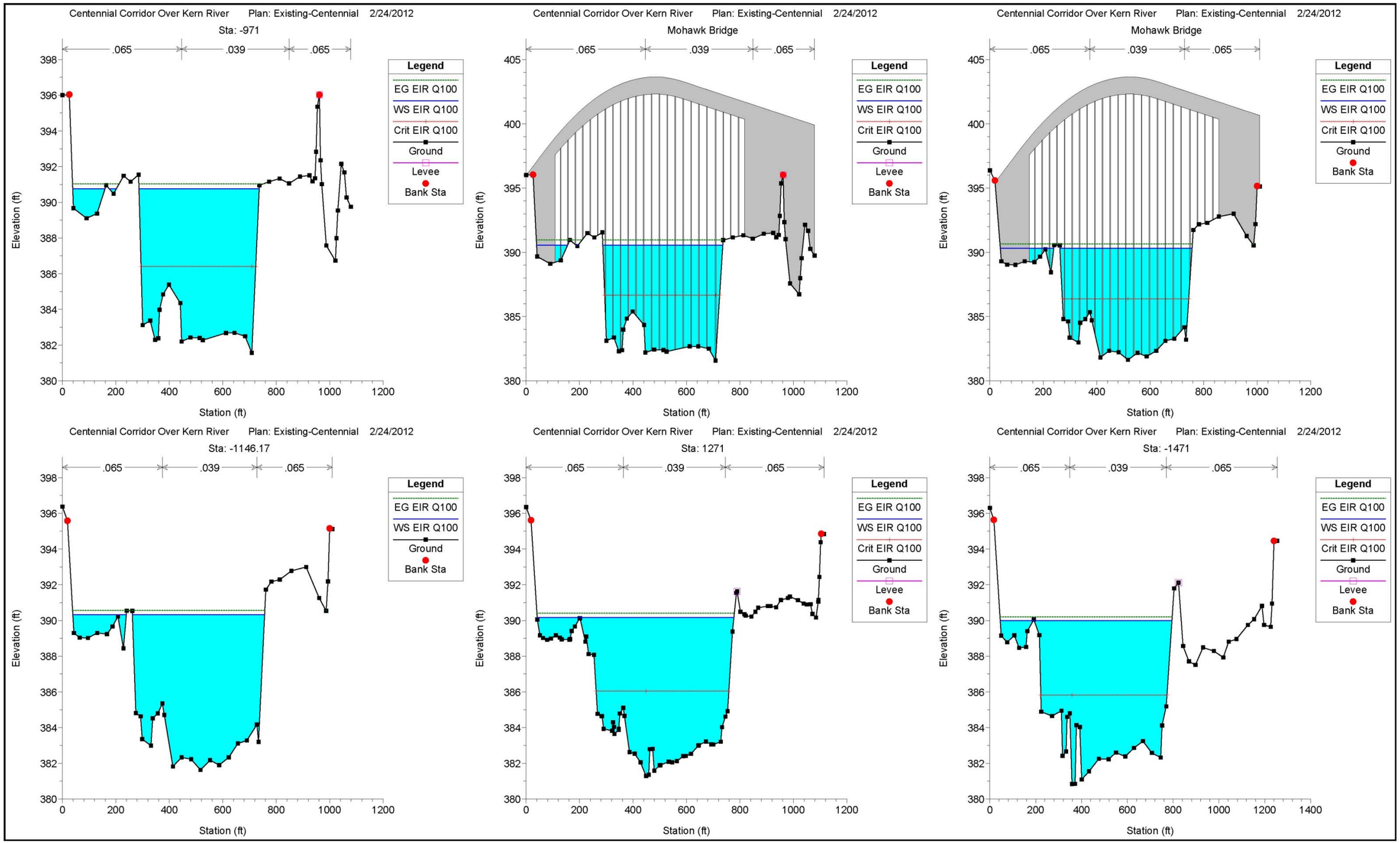
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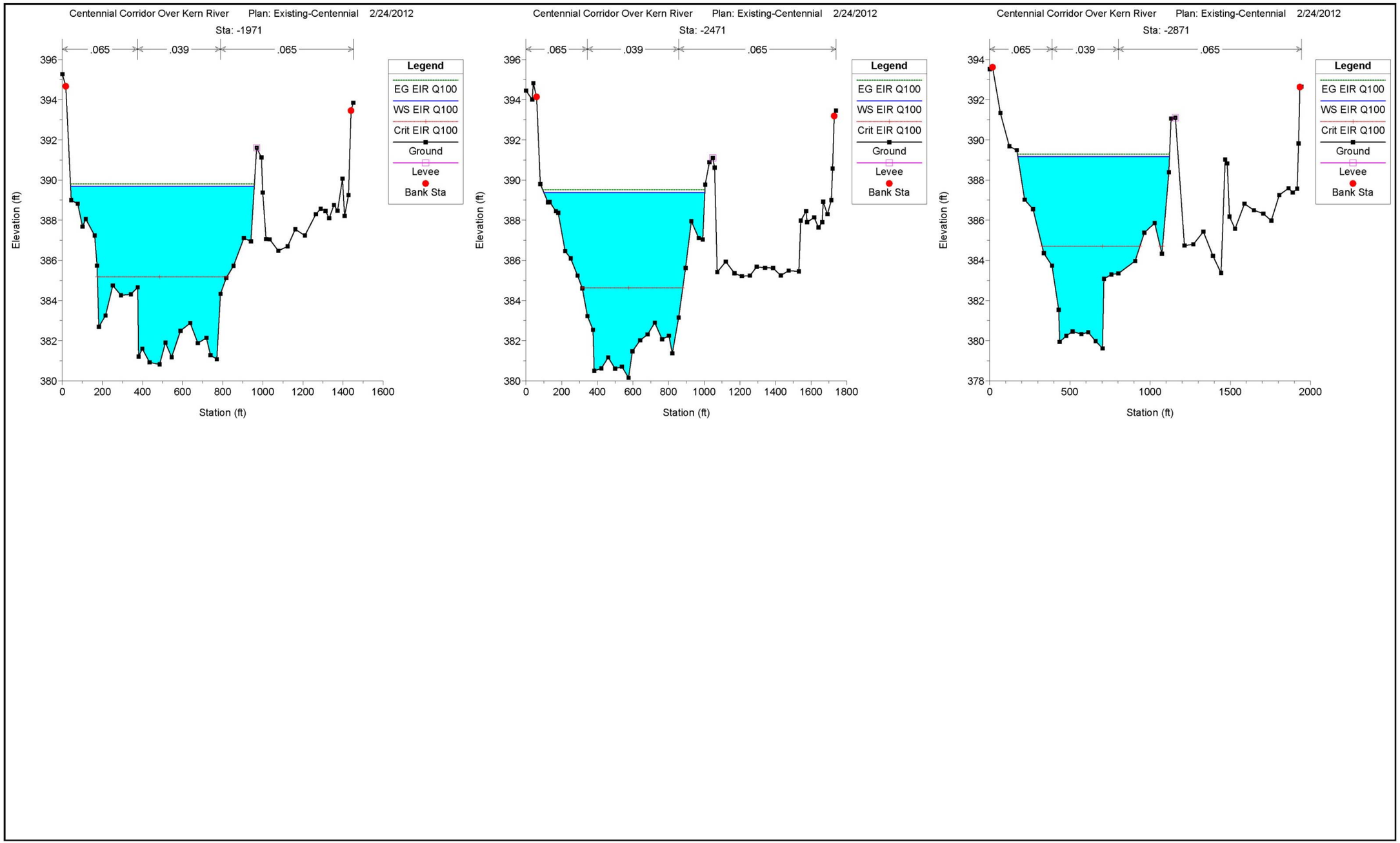
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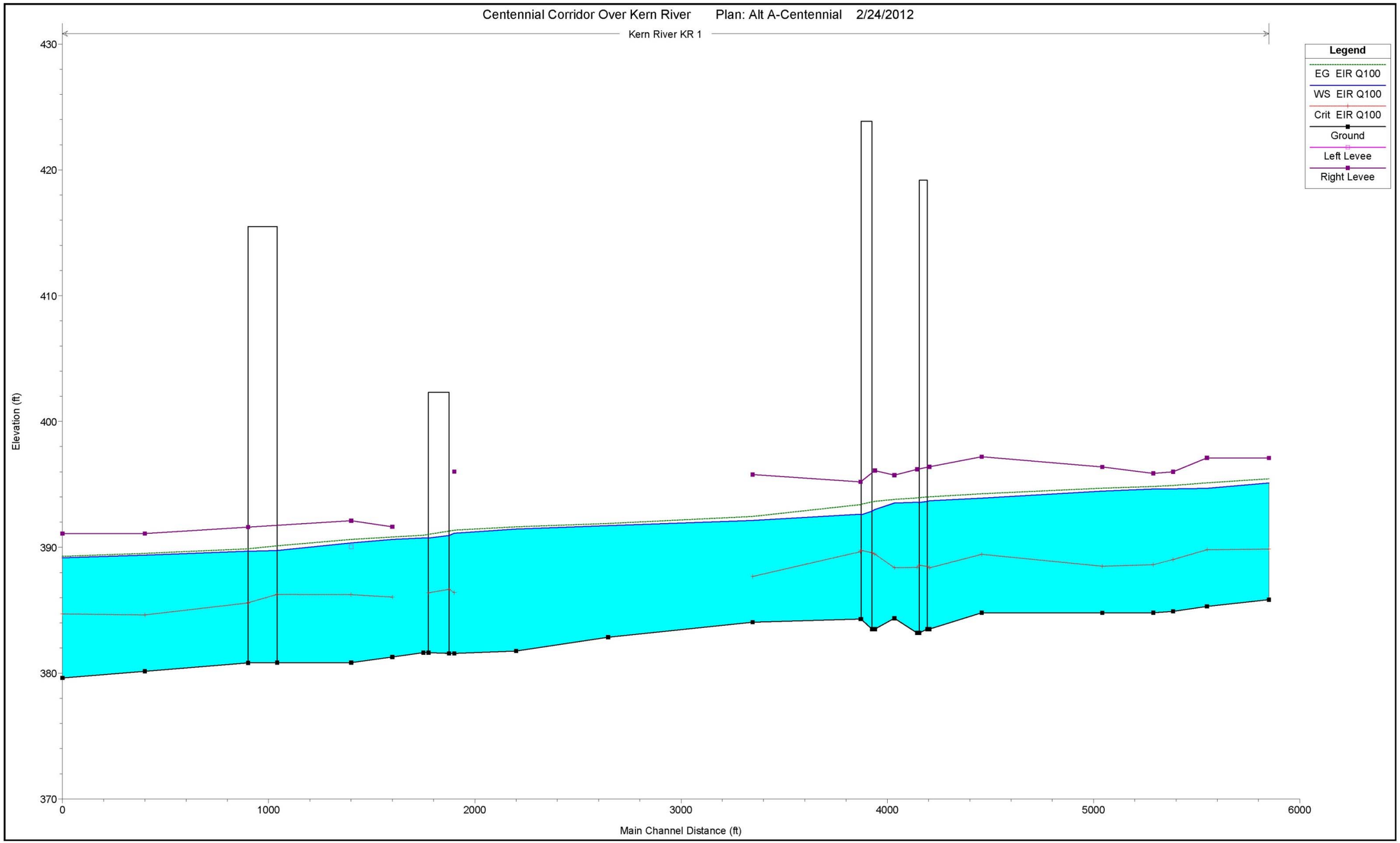
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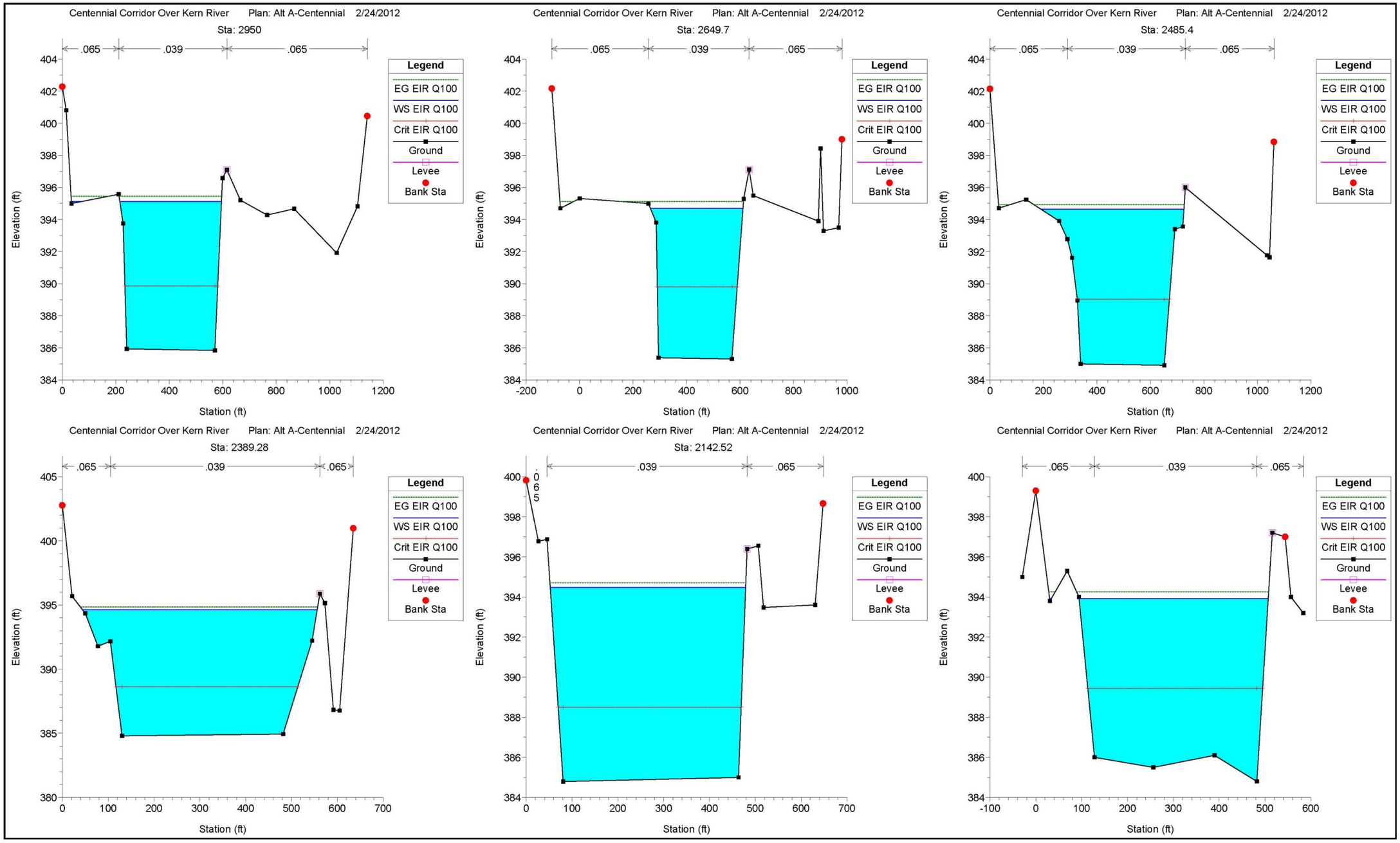
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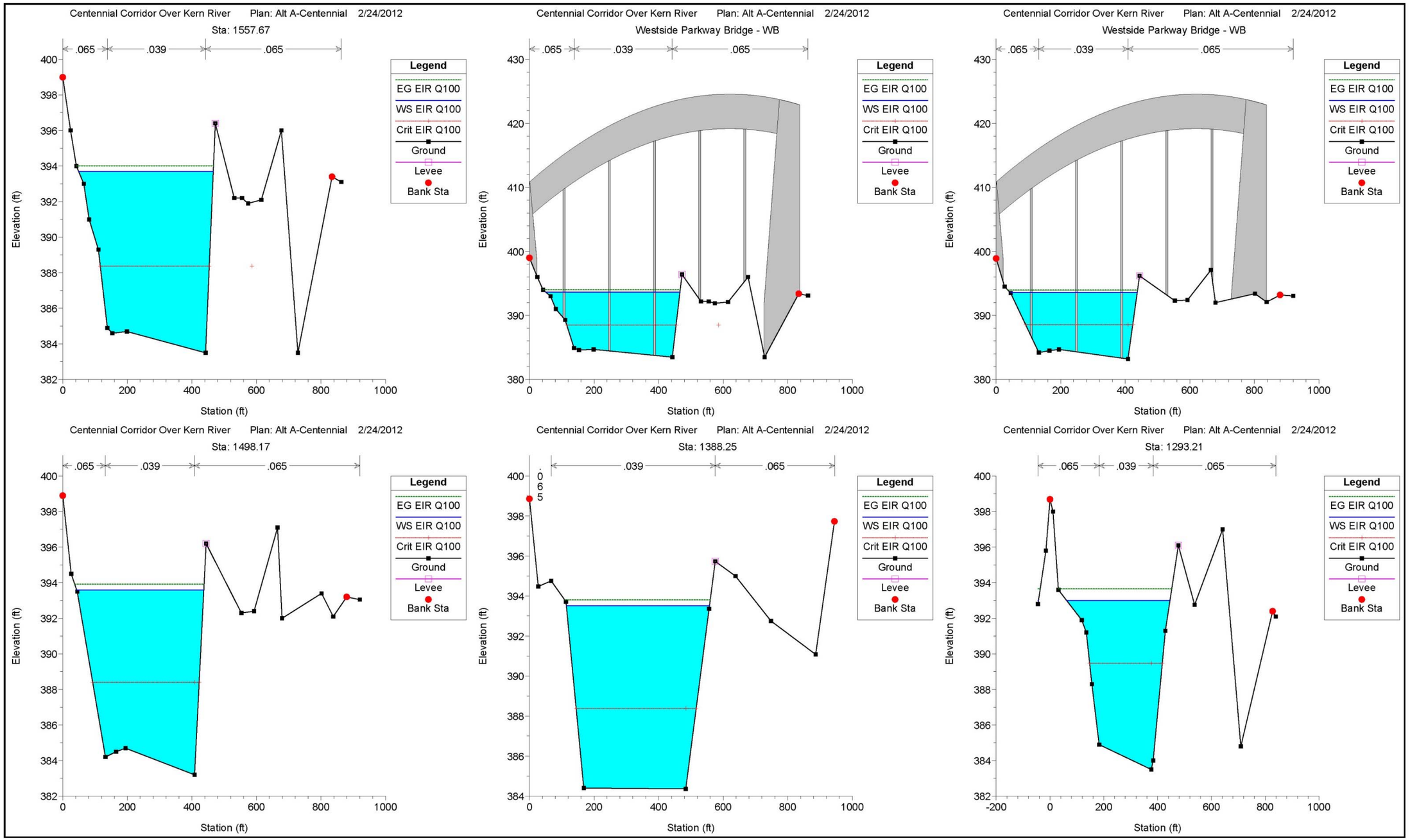
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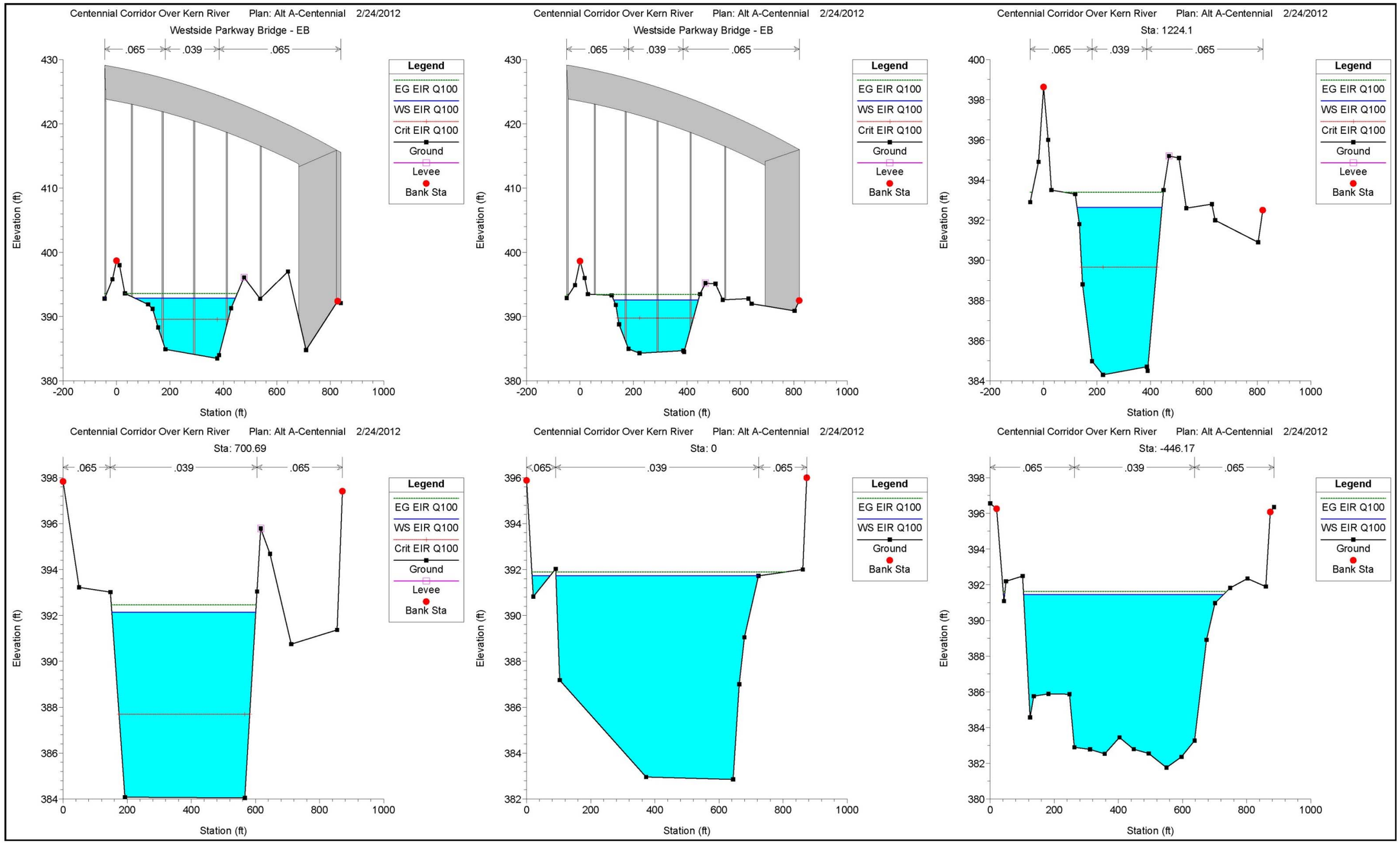
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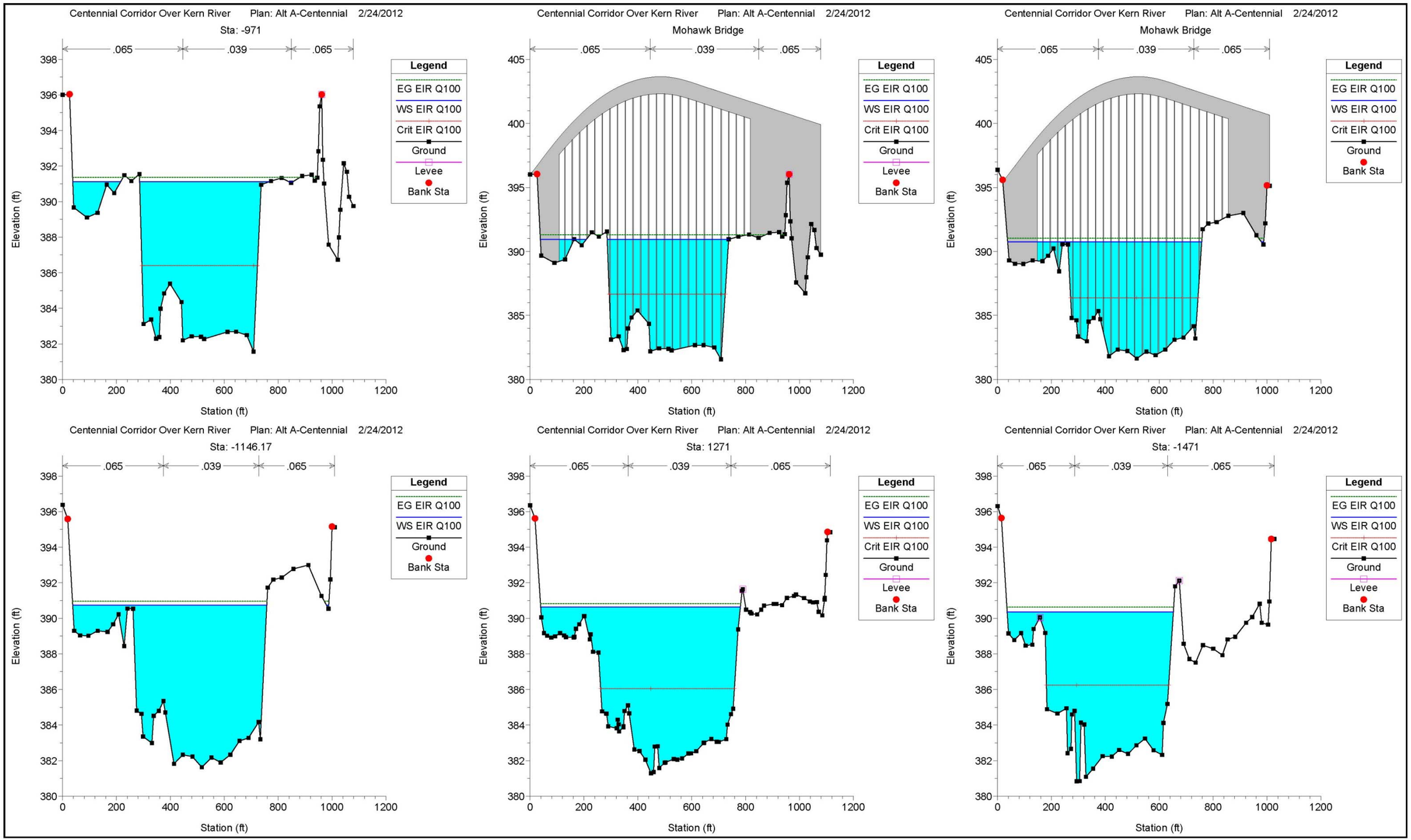
Station (ft)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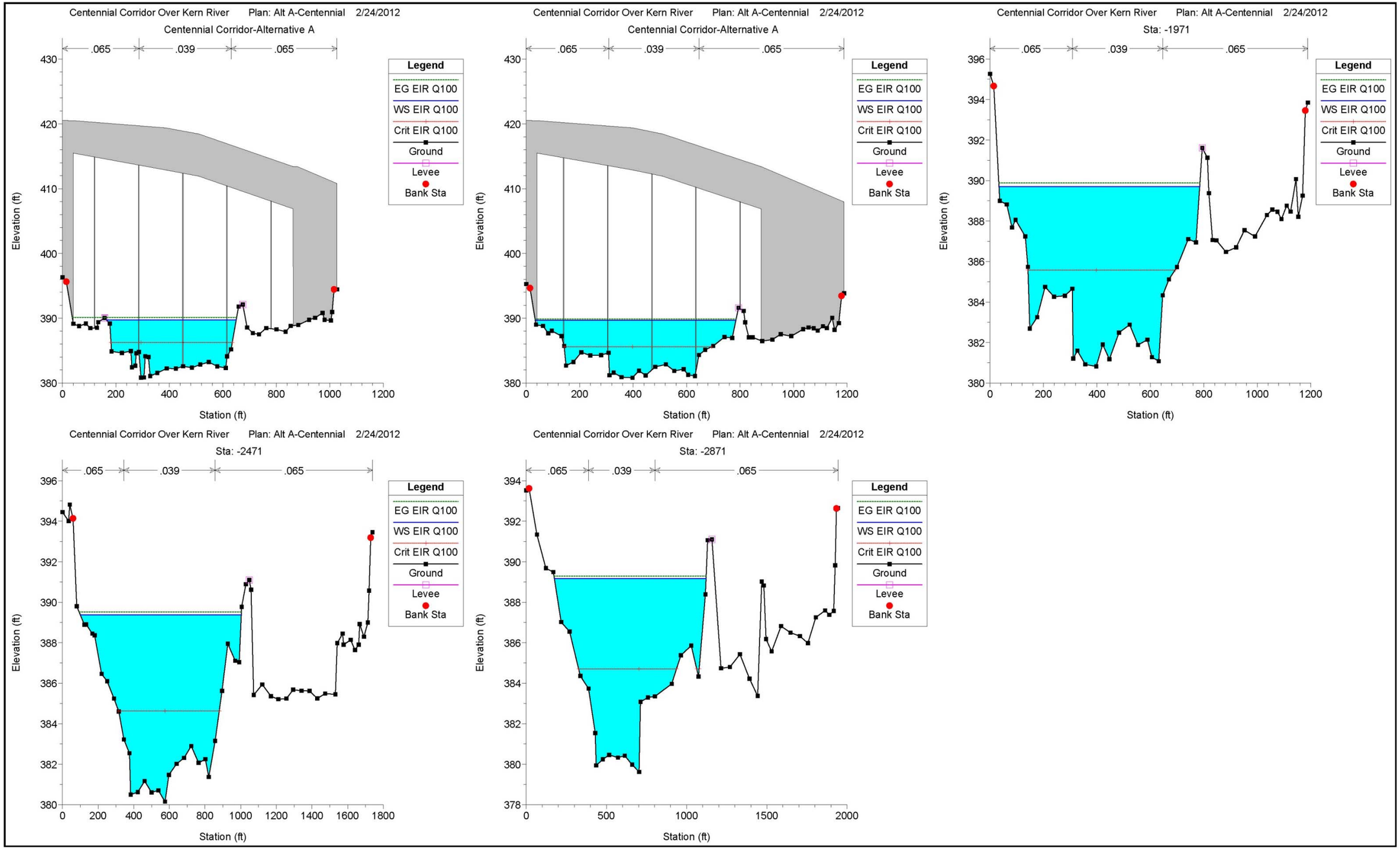
Mohawk Bridge
Sta: -1146.17
Sta: 1271
Sta: -1471
.065
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)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Centennial Corridor-Alternative A
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Legend
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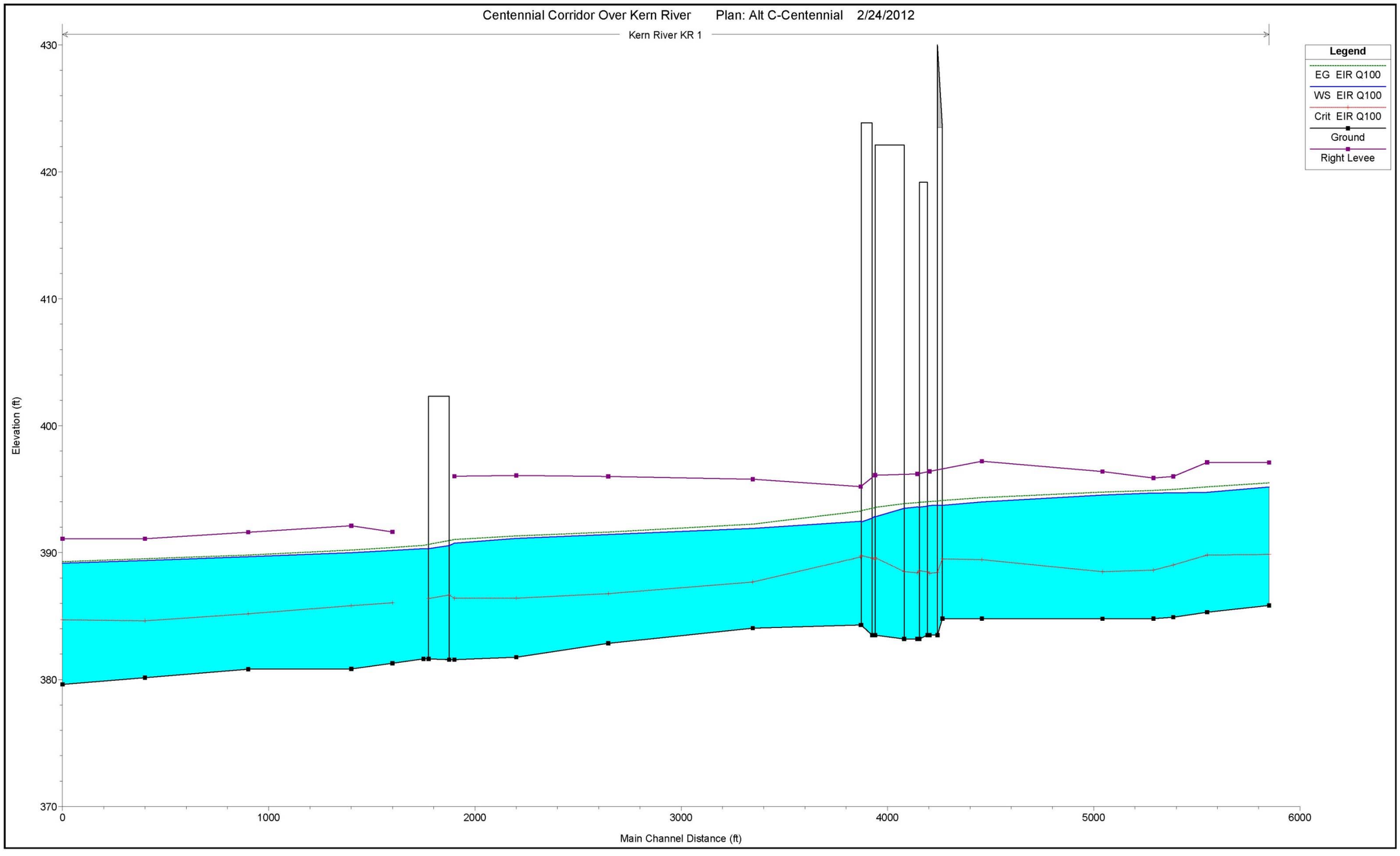
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt A-Centennial 2/24/2012
Centennial Corridor-Alternative A
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt A-Centennial 2/24/2012
Sta: -1971
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt A-Centennial 2/24/2012
Sta: -2471
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt A-Centennial 2/24/2012
Sta: -2871
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)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Kern River KR 1
Legend
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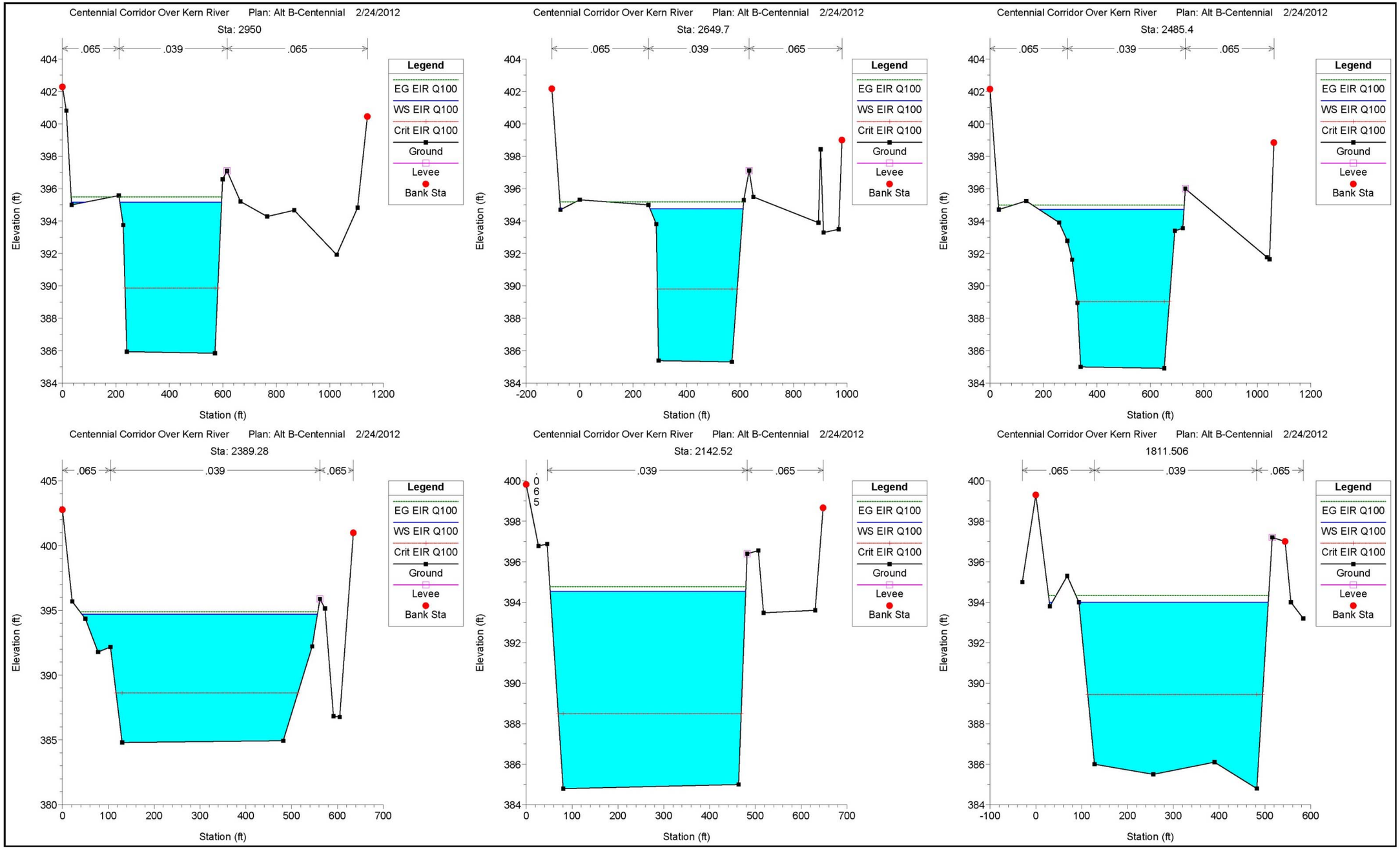
WS EIR Q100
Crit EIR Q100
Ground
Right Levee
Elevation (ft)
430
420
410
400
390
380
370
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)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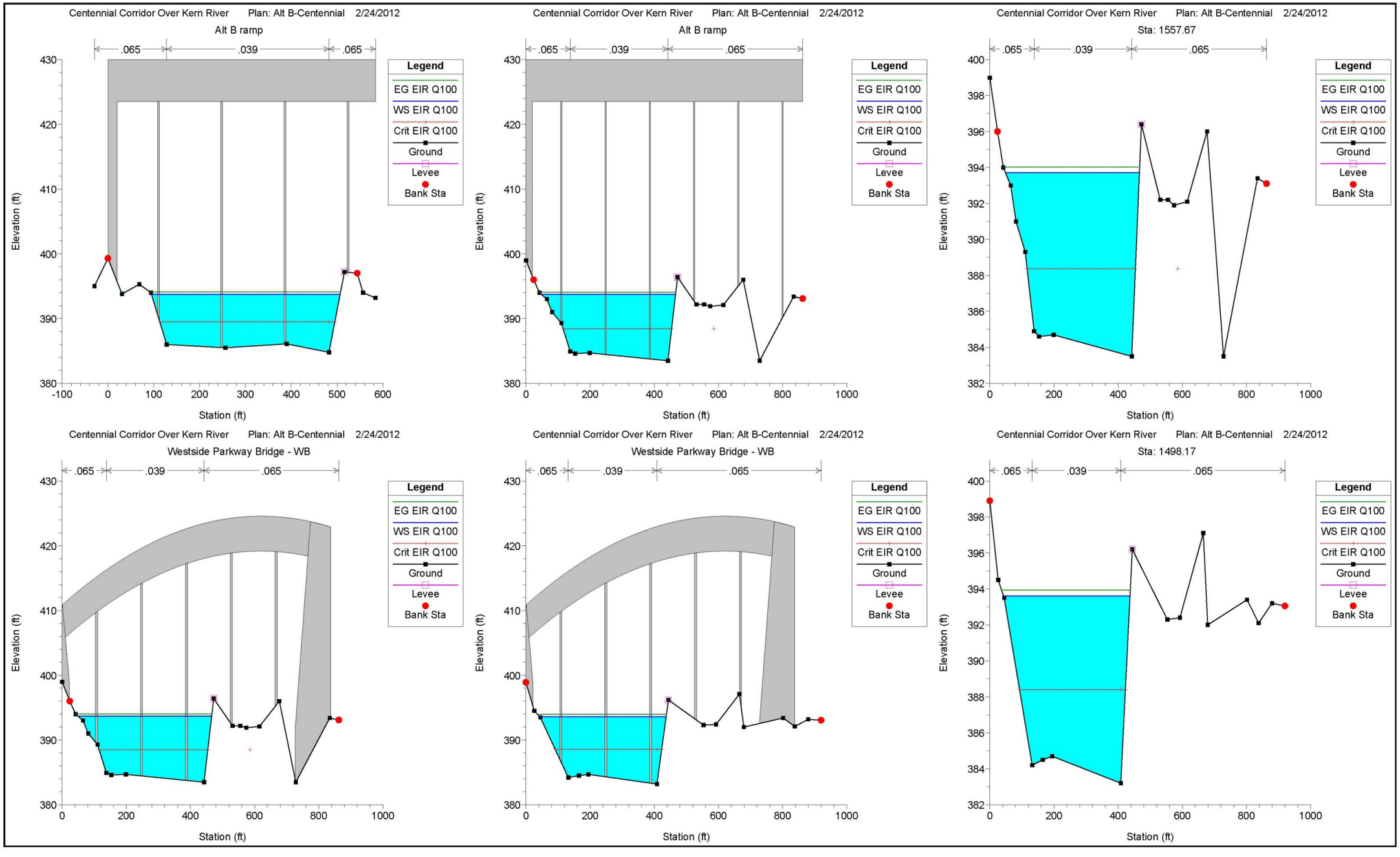
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 2649.7
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 2485.4
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 2389.28
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 2142.52
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
1811.506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Alt B ramp
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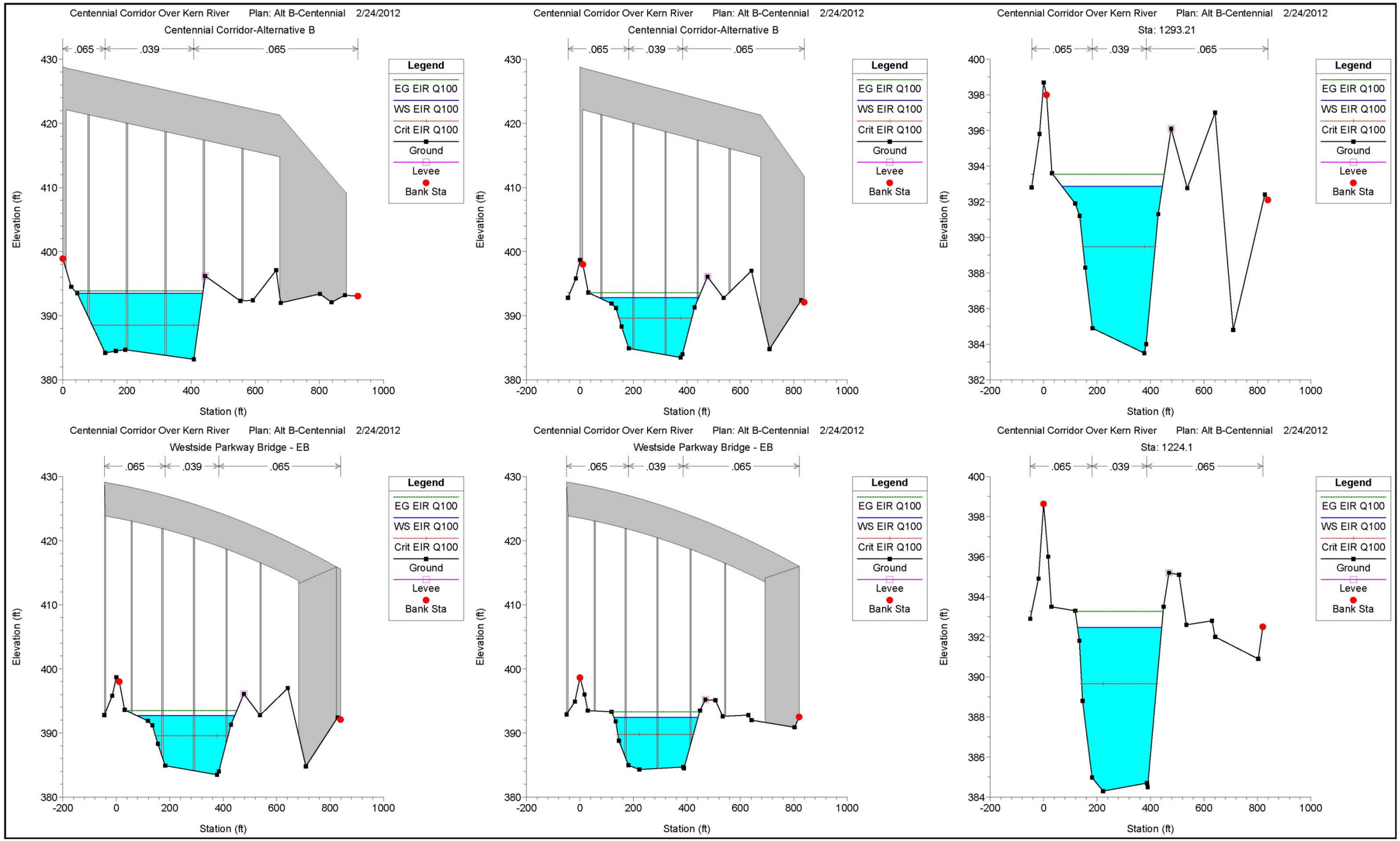
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Alt B ramp
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 1557.67
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Westside Parkway Bridge - WB
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Westside Parkway Bridge - WB
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 1498.17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WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Centennial Corridor-Alternative B
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 1293.21
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Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Westside Parkway Bridge - EB
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Westside Parkway Bridge - EB
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 1224.1
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Legend
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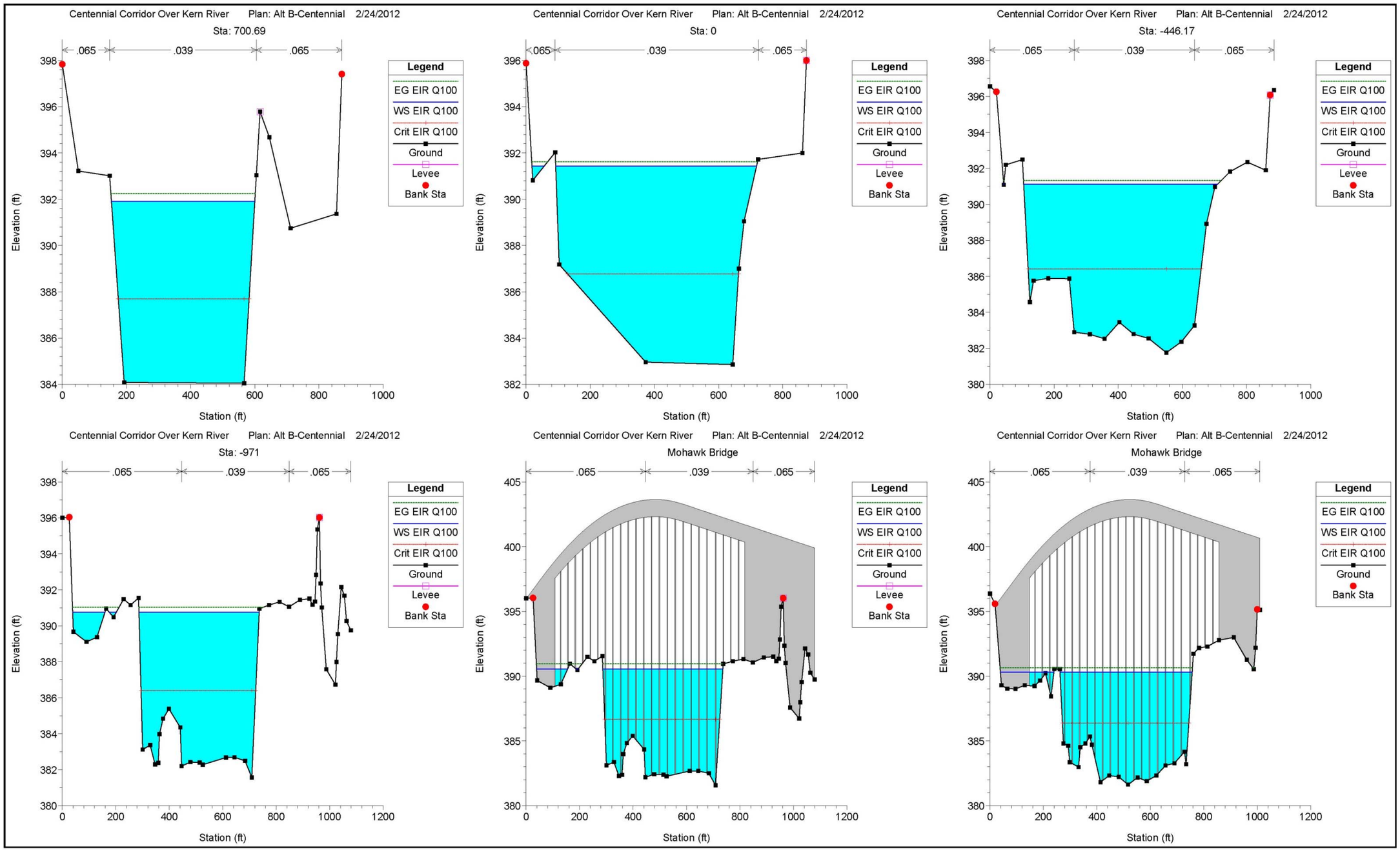
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)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Sta: 700.69
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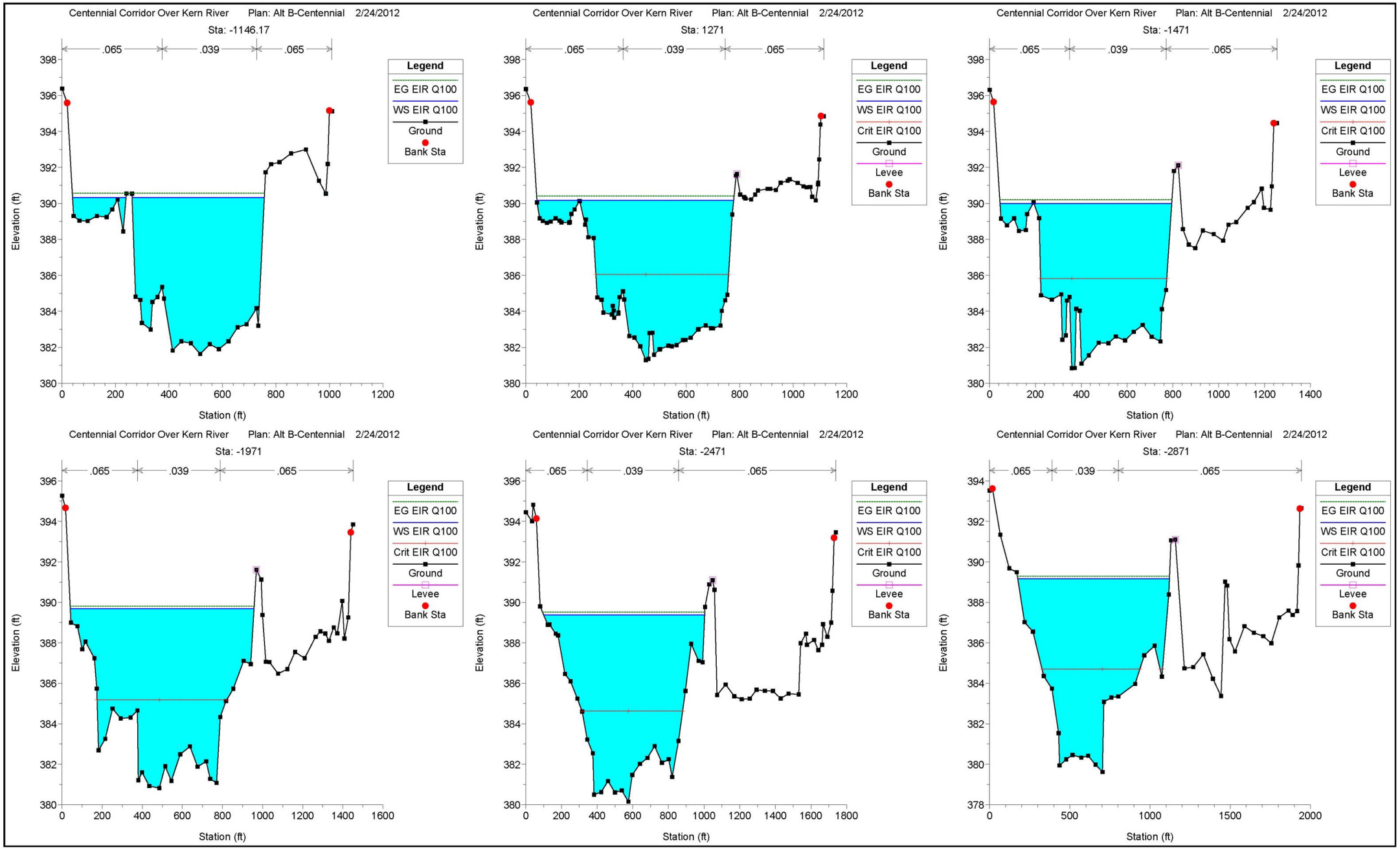
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 0
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: -446.17
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: -971
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Mohawk Bridge
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Mohawk Bridge


Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: -1146.17
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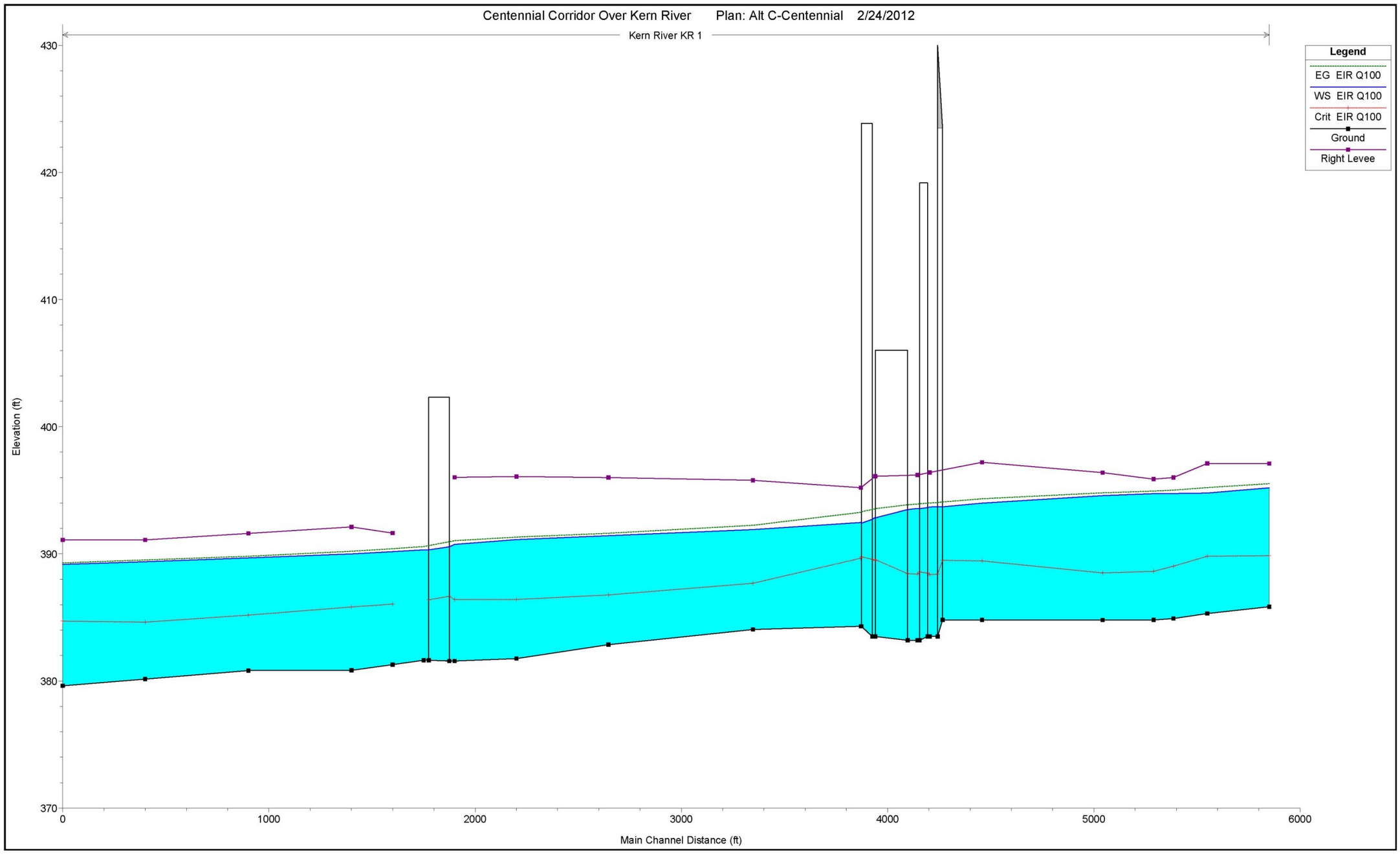
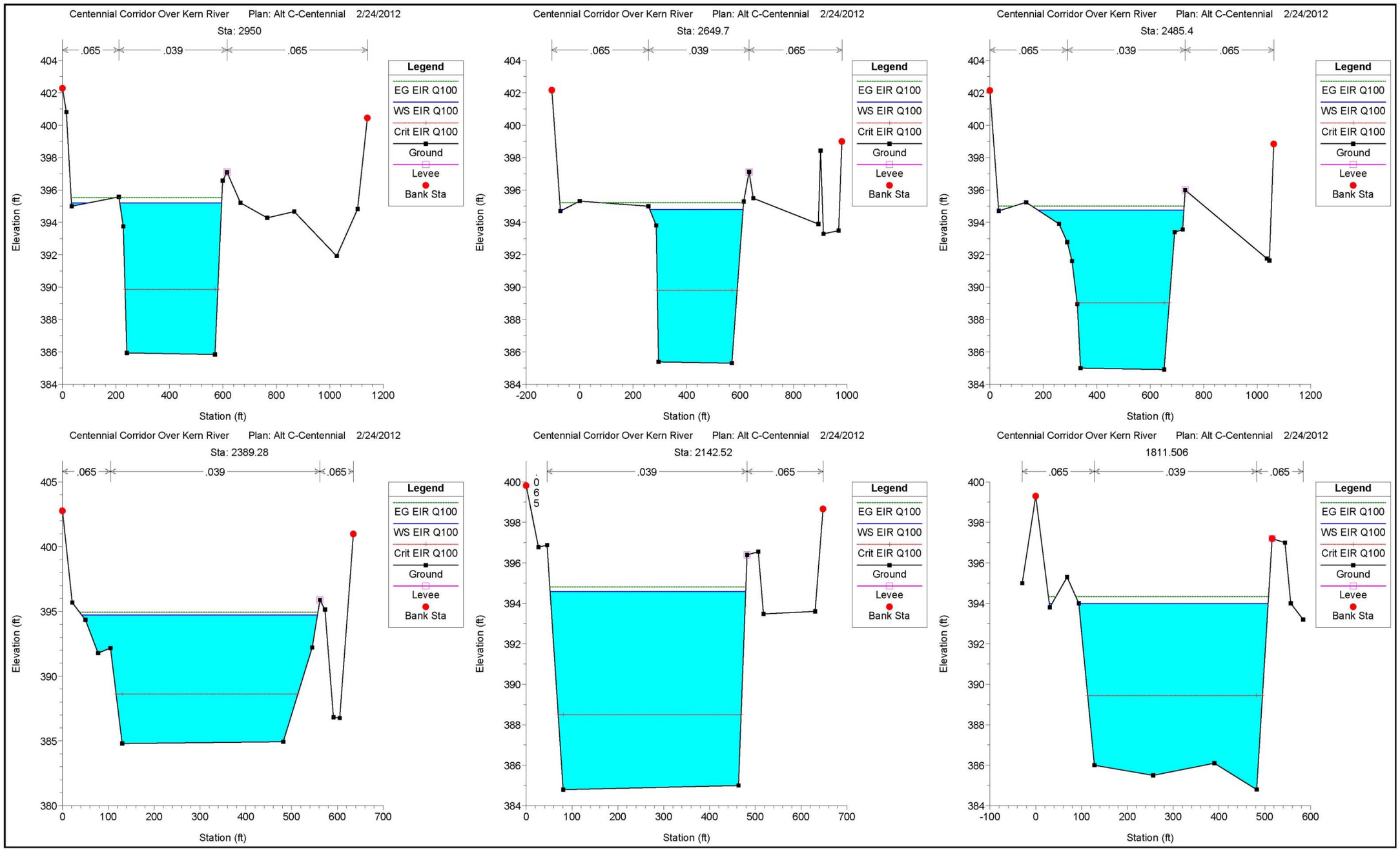
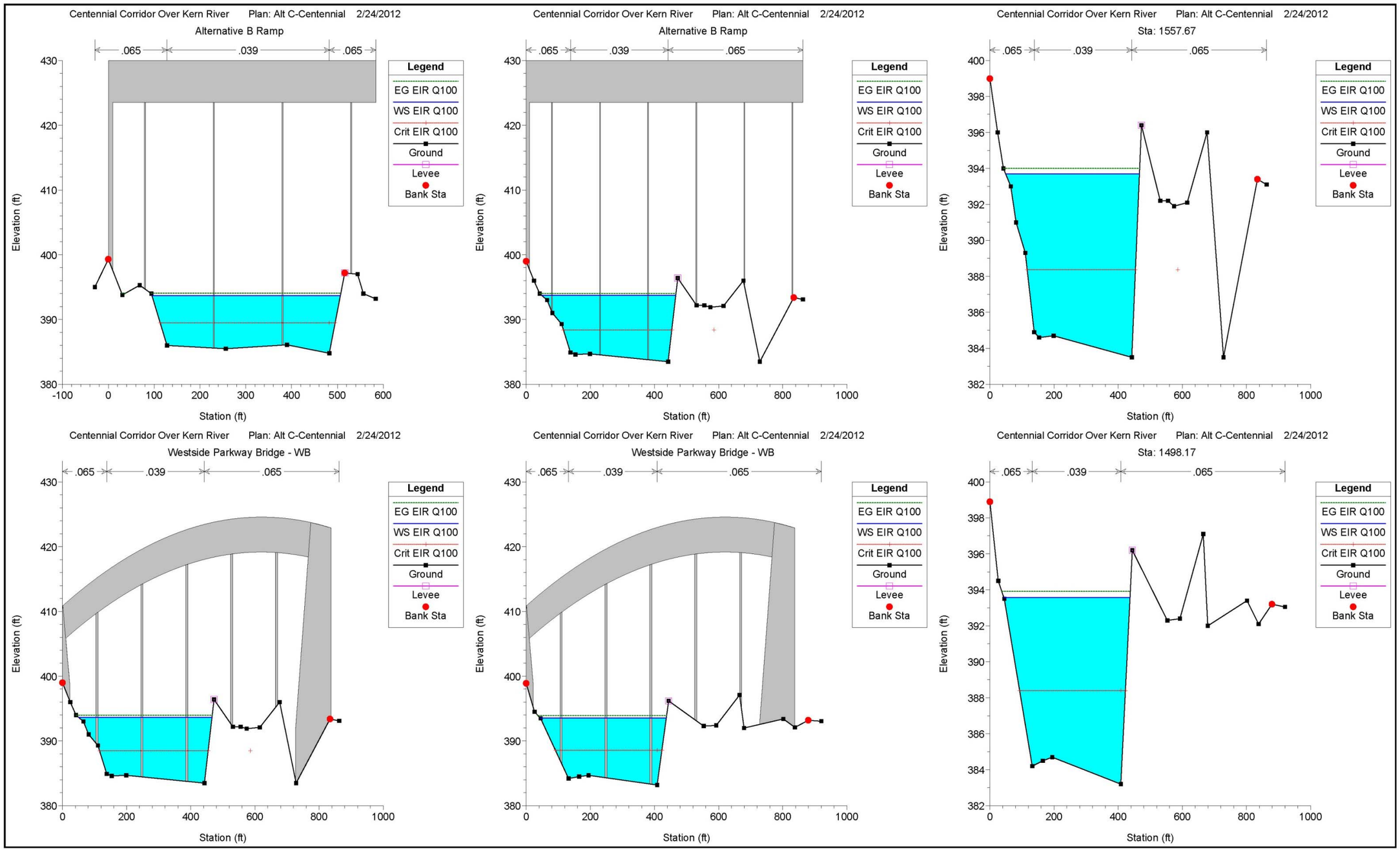
Legend
EG EIR Q100
WS EIR Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: 1271
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: -1471
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: -1971
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: -2471
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt B-Centennial 2/24/2012
Sta: -2871
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Kern River KR 1
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Right Levee
Elevation (ft)
430
420
410
400
390
380
370
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)


Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 2950
.065
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 2649.7
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 2485.4
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 2389.28
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 2142.52
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
1811.506


Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Alternative B Ramp
.065
.039
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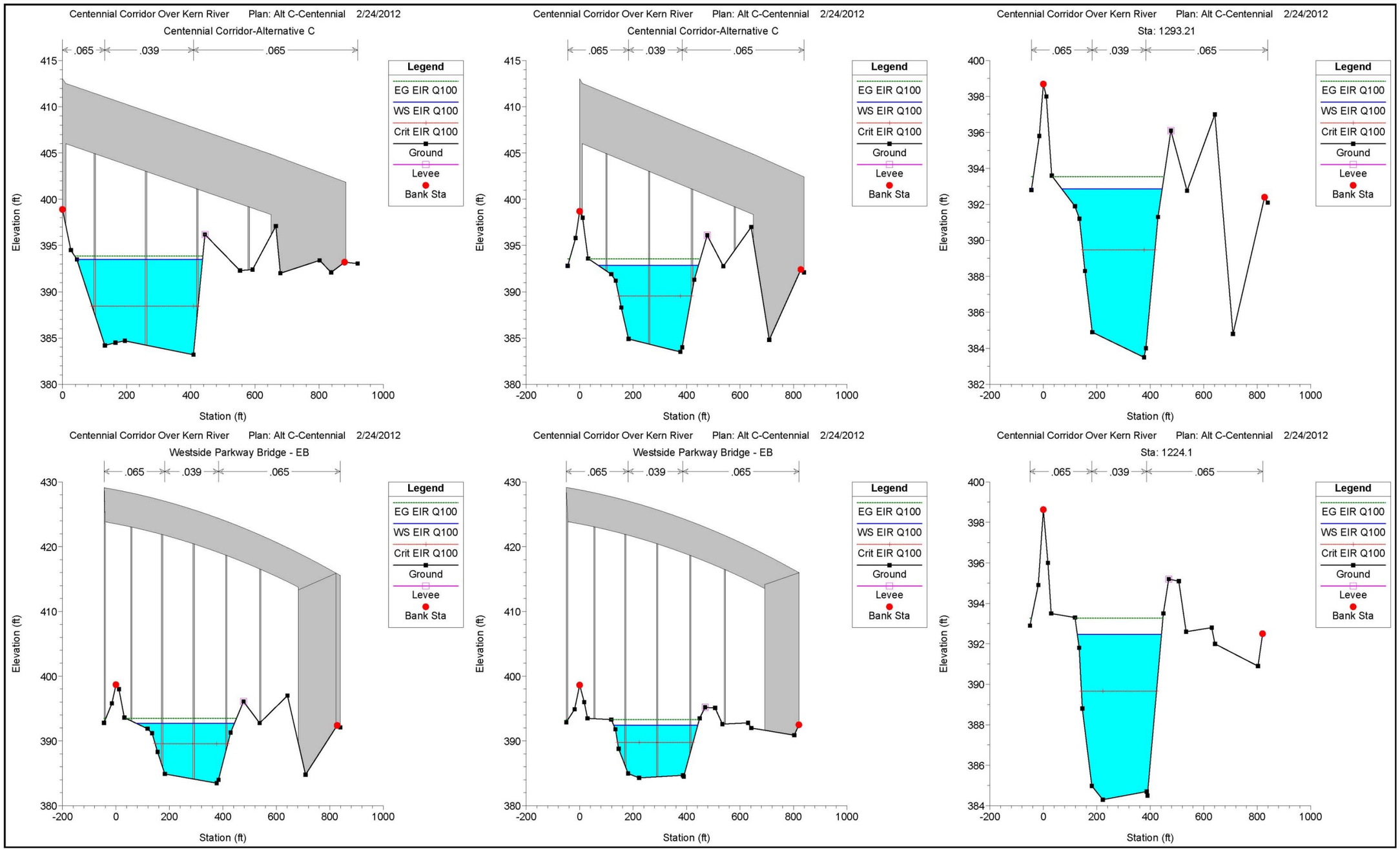
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Alternative B Ramp
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 1557.67
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Westside Parkway Bridge - WB
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Westside Parkway Bridge - WB
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 1498.17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Centennial Corridor-Alternative C
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Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Centennial Corridor-Alternative C
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 1293.21
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Westside Parkway Bridge - EB
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Westside Parkway Bridge - EB
.065 .039 .065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 1224.1
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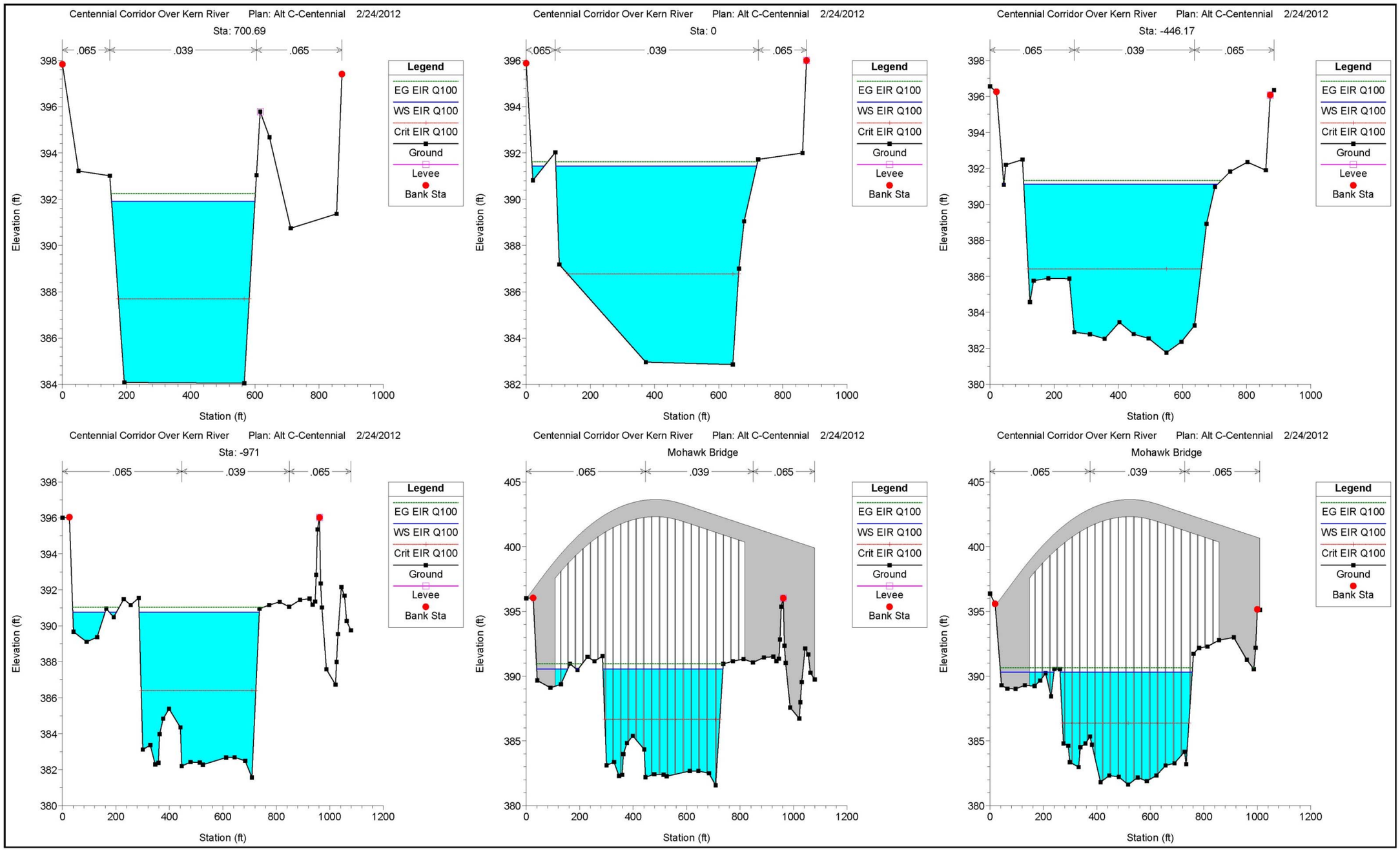
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 700.69
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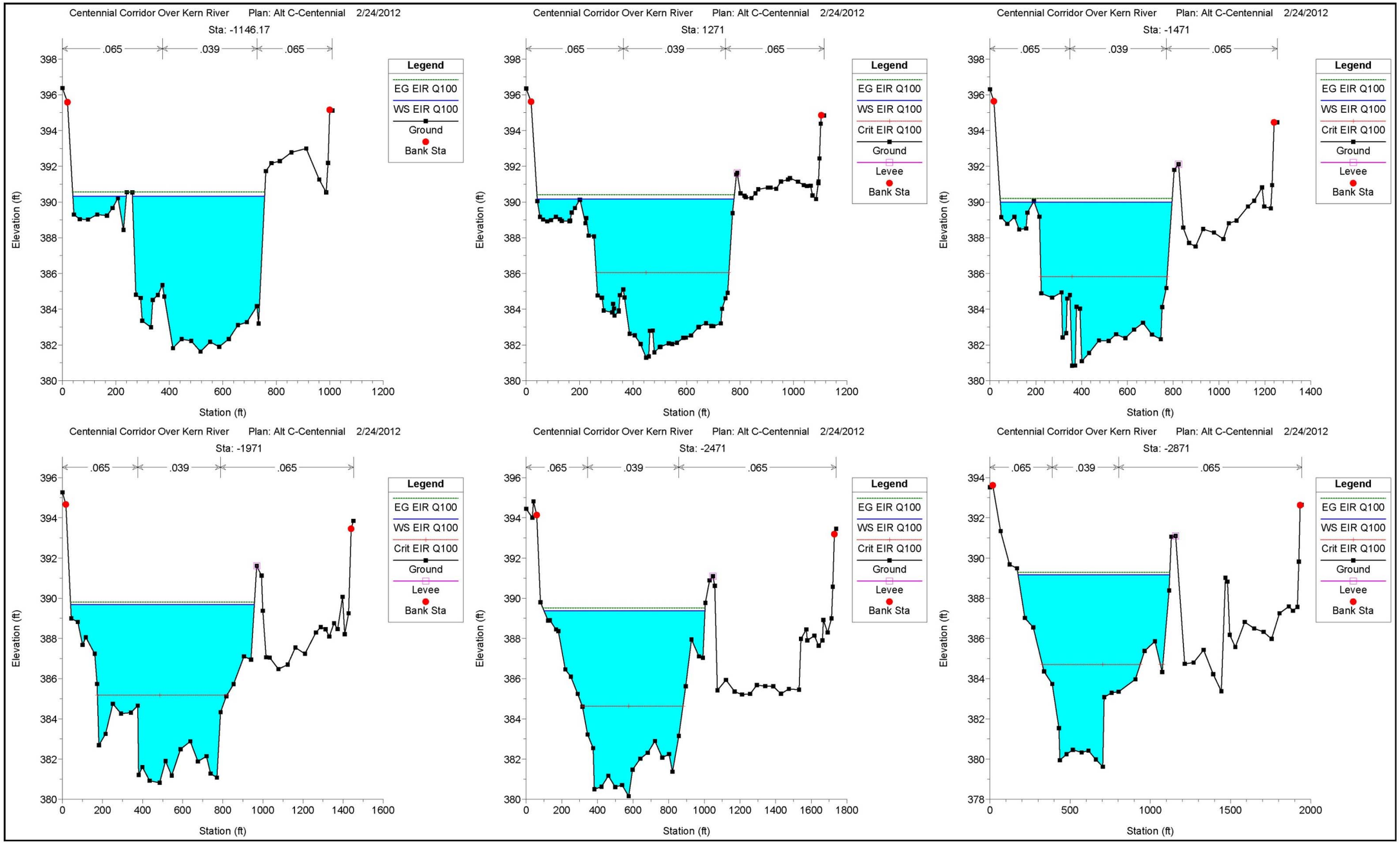
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 0
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: -446.17
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: -971
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Mohawk Bridge
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Mohawk Bridge


Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: -1146.17
.065
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: 1271
.065
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: -1471
.065
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: -1971
.065
.039
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Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: -2471
.065
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Centennial Corridor Over Kern River Plan: Alt C-Centennial 2/24/2012
Sta: -2871
.065
.039
.065
Legend
EG EIR Q100
WS EIR Q100
Crit EIR Q100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

Appendix E HEC-RAS Modeling Results (Tabular Format)

Existing Conditions:

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.10	389.86	395.44	0.000868	4.64	3232.27	412.00	0.29
KR 1	2649.70	EIR Q100	15000.00	385.31	394.67	389.81	395.12	0.001227	5.34	2806.71	345.84	0.33
KR 1	2485.4	EIR Q100	15000.00	384.91	394.63	389.03	394.91	0.000788	4.21	3563.86	533.50	0.29
KR 1	2389.28	EIR Q100	15000.00	384.80	394.62	388.63	394.83	0.000534	3.66	4093.06	511.85	0.23
KR 1	2142.52	EIR Q100	15000.00	384.80	394.46	388.50	394.69	0.000555	3.88	3867.00	426.37	0.23
KR 1	1811.506	EIR Q100	15000.00	384.80	393.84	389.45	394.20	0.001326	4.79	3128.41	413.38	0.31
KR 1	1557.67	EIR Q100	15000.00	383.50	393.59	388.37	393.92	0.000872	4.57	3283.57	414.57	0.29
KR 1	1527.865		Bridge									
KR 1	1498.17	EIR Q100	15000.00	383.20	393.48	388.41	393.83	0.000993	4.77	3147.23	391.59	0.30
KR 1	1388.25	EIR Q100	15000.00	384.36	393.41	388.38	393.71	0.000868	4.38	3421.23	441.90	0.28
KR 1	1293.24	EIR Q100	15000.00	383.50	392.87	389.47	393.54	0.002400	6.61	2270.43	376.33	0.47
KR 1	1254.20		Bridge									
KR 1	1224.1	EIR Q100	15000.00	384.30	392.47	389.66	393.27	0.003004	7.19	2085.94	314.97	0.49
KR 1	700.69	EIR Q100	15000.00	384.05	391.91	387.69	392.25	0.001080	4.66	3219.32	446.87	0.31
KR 1	0	EIR Q100	15000.00	382.85	391.43	386.77	391.62	0.000655	3.50	4290.64	664.21	0.24
KR 1	-446.17	EIR Q100	15000.00	381.76	391.12	386.42	391.32	0.000693	3.56	4219.33	605.13	0.24
KR 1	-971	EIR Q100	15000.00	381.57	390.75	386.41	391.03	0.001300	4.29	3499.67	596.10	0.31
KR 1	-1046		Bridge									
KR 1	-1121	EIR Q100	15000.00	381.63	390.32		390.57	0.001099	4.05	3706.53	694.62	0.31
KR 1	-1271	EIR Q100	15000.00	381.29	390.17	386.05	390.41	0.001028	3.89	3851.69	736.00	0.30
KR 1	-1471	EIR Q100	15000.00	380.84	390.00	385.82	390.21	0.000903	3.68	4078.64	745.57	0.28
KR 1	-1971	EIR Q100	15000.00	380.82	389.68	385.18	389.81	0.000619	2.88	5207.03	916.35	0.21
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21

Alternative A:

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.12	389.86	395.45	0.000864	4.63	3237.79	416.32	0.29
KR 1	2649.70	EIR Q100	15000.00	385.31	394.69	389.81	395.13	0.001222	5.33	2812.02	346.28	0.33
KR 1	2485.4	EIR Q100	15000.00	384.91	394.65	389.03	394.92	0.000783	4.20	3572.42	535.05	0.29
KR 1	2389.28	EIR Q100	15000.00	384.80	394.63	388.63	394.84	0.000531	3.66	4101.30	512.27	0.23
KR 1	2142.52	EIR Q100	15000.00	384.80	394.47	388.50	394.70	0.000552	3.87	3874.10	426.45	0.23
KR 1	1811.506	EIR Q100	15000.00	384.80	393.91	389.45	394.26	0.001038	4.75	3157.18	416.00	0.30
KR 1	1557.67	EIR Q100	15000.00	383.50	393.70	388.37	394.01	0.000840	4.51	3326.92	417.20	0.28
KR 1	1527.865		Bridge									
KR 1	1498.17	EIR Q100	15000.00	383.20	393.58	388.41	393.93	0.000954	4.70	3189.78	393.68	0.29
KR 1	1388.25	EIR Q100	15000.00	384.36	393.52	388.38	393.81	0.000831	4.32	3470.77	443.46	0.27
KR 1	1293.24	EIR Q100	15000.00	383.50	393.01	389.47	393.65	0.002264	6.45	2325.08	386.48	0.46
KR 1	1254.20		Bridge									
KR 1	1224.1	EIR Q100	15000.00	384.30	392.64	389.66	393.40	0.002793	7.01	2139.31	317.88	0.48
KR 1	700.69	EIR Q100	15000.00	384.05	392.14	387.69	392.46	0.000979	4.51	3322.75	449.02	0.29
KR 1	0	EIR Q100	15000.00	382.85	391.72		391.90	0.000576	3.34	4487.47	687.66	0.23
KR 1	-446.17	EIR Q100	15000.00	381.76	391.45		391.63	0.000608	3.39	4422.25	627.69	0.23
KR 1	-971	EIR Q100	15000.00	381.57	391.12	386.41	391.37	0.001266	4.02	3731.03	672.56	0.30
KR 1	-1046		Bridge									
KR 1	-1121	EIR Q100	15000.00	381.63	390.74		390.96	0.000904	3.74	4009.30	728.60	0.28
KR 1	-1271	EIR Q100	15000.00	381.29	390.63	386.05	390.83	0.000821	3.58	4189.03	741.04	0.27
KR 1	-1471	EIR Q100	15000.00	380.84	390.35	386.24	390.63	0.001135	4.21	3559.60	616.81	0.31
KR 1	-1900		Bridge									
KR 1	-1971	EIR Q100	15000.00	380.82	389.69	385.58	389.89	0.000919	3.51	4273.42	750.72	0.26
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21

*Maximum c***_change in Water Surface = 0.35 ft upstream of new bridge (Station -1471)._**

Alternative B:

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.17	389.86	395.50	0.000848	4.60	3260.68	433.77	0.30
KR 1	2649.70	EIR Q100	15000.00	385.31	394.75	389.81	395.19	0.001200	5.29	2833.62	354.33	0.33
KR 1	2485.4	EIR Q100	15000.00	384.91	394.71	389.03	394.98	0.000763	4.16	3607.02	541.41	0.28
KR 1	2389.28	EIR Q100	15000.00	384.80	394.70	388.63	394.90	0.000518	3.63	4134.37	513.96	0.23
KR 1	2142.52	EIR Q100	15000.00	384.80	394.54	388.50	394.77	0.000539	3.84	3903.02	426.76	0.22
KR 1	1811.506	EIR Q100	15000.00	384.80	393.99	389.45	394.34	0.001004	4.70	3192.45	419.19	0.30
KR 1	1607.37		Bridge									
KR 1	1557.67	EIR Q100	15000.00	383.50	393.71	388.37	394.03	0.000835	4.50	3333.71	417.61	0.28
KR 1	1527.865		Bridge									
KR 1	1498.17	EIR Q100	15000.00	383.20	393.60	388.41	393.94	0.000949	4.69	3196.44	394.05	0.29
KR 1	1364.24		Bridge									
KR 1	1293.24	EIR Q100	15000.00	383.50	392.87	389.47	393.54	0.002400	6.61	2270.43	376.33	0.47
KR 1	1254.20		Bridge									
KR 1	1224.1	EIR Q100	15000.00	384.30	392.47	389.66	393.27	0.003004	7.19	2085.94	314.97	0.49
KR 1	700.69	EIR Q100	15000.00	384.05	391.91	387.69	392.25	0.001080	4.66	3219.32	446.87	0.31
KR 1	0	EIR Q100	15000.00	382.85	391.43	386.77	391.62	0.000655	3.50	4290.64	664.21	0.24
KR 1	-446.17	EIR Q100	15000.00	381.76	391.12	386.42	391.32	0.000693	3.56	4219.33	605.13	0.24
KR 1	-971	EIR Q100	15000.00	381.57	390.75	386.41	391.03	0.001300	4.29	3499.67	596.10	0.31
KR 1	-1046		Bridge									
KR 1	-1121	EIR Q100	15000.00	381.63	390.32		390.57	0.001099	4.05	3706.53	694.62	0.31
KR 1	-1271	EIR Q100	15000.00	381.29	390.17	386.05	390.41	0.001028	3.89	3851.69	736.00	0.30
KR 1	-1471	EIR Q100	15000.00	380.84	390.00	385.82	390.21	0.000903	3.68	4078.64	745.57	0.28
KR 1	-1971	EIR Q100	15000.00	380.82	389.68	385.18	389.81	0.000619	2.88	5207.03	916.35	0.21
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21

*Maximum c***_change in Water Surface = 0.15 ft upstream of new bridges (Station 1811)._**

Alternative C:

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.20	389.86	395.53	0.000839	4.58	3274.08	443.68	0.30	
KR 1	2649.70	EIR Q100	15000.00	385.31	394.79	389.81	395.22	0.001187	5.27	2846.10	359.61	0.33	
KR 1	2485.4	EIR Q100	15000.00	384.91	394.75	389.03	395.01	0.000752	4.14	3626.89	552.10	0.28	
KR 1	2389.28	EIR Q100	15000.00	384.80	394.73	388.63	394.94	0.000512	3.61	4153.10	514.91	0.22	
KR 1	2142.52	EIR Q100	15000.00	384.80	394.58	388.50	394.81	0.000532	3.83	3919.39	426.93	0.22	
KR 1	1811.506	EIR Q100	15000.00	384.80	393.99	389.45	394.33	0.001284	4.70	3190.43	419.01	0.30	
KR 1	1607.37		Bridge										
KR 1	1557.67	EIR Q100	15000.00	383.50	393.69	388.37	394.00	0.000844	4.52	3321.48	416.87	0.28	
KR 1	1527.865		Bridge										
KR 1	1498.17	EIR Q100	15000.00	383.20	393.57	388.41	393.91	0.000959	4.71	3184.43	393.39	0.29	
KR 1	1372.24		Bridge										
KR 1	1293.24	EIR Q100	15000.00	383.50	392.87	389.47	393.54	0.002400	6.61	2270.43	376.33	0.47	
KR 1	1254.20		Bridge										
KR 1	1224.1	EIR Q100	15000.00	384.30	392.47	389.66	393.27	0.003004	7.19	2085.94	314.97	0.49	
KR 1	700.69	EIR Q100	15000.00	384.05	391.91	387.69	392.25	0.001080	4.66	3219.32	446.87	0.31	
KR 1	0	EIR Q100	15000.00	382.85	391.43	386.77	391.62	0.000655	3.50	4290.64	664.21	0.24	
KR 1	-446.17	EIR Q100	15000.00	381.76	391.12	386.42	391.32	0.000693	3.56	4219.33	605.13	0.24	
KR 1	-971	EIR Q100	15000.00	381.57	390.75	386.41	391.03	0.001300	4.29	3499.67	596.10	0.31	
KR 1	-1046		Bridge										
KR 1	-1121	EIR Q100	15000.00	381.63	390.32		390.57	0.001099	4.05	3706.53	694.62	0.31	
KR 1	-1271	EIR Q100	15000.00	381.29	390.17	386.05	390.41	0.001028	3.89	3851.69	736.00	0.30	
KR 1	-1471	EIR Q100	15000.00	380.84	390.00	385.82	390.21	0.000903	3.68	4078.64	745.57	0.28	
KR 1	-1971	EIR Q100	15000.00	380.82	389.68	385.18	389.81	0.000619	2.88	5207.03	916.35	0.21	
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22	
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21	

*Maximum c***_change in Water Surface = 0.15 ft upstream of new bridges (Station 1811)._**

Attachment A Flood Evaluation Report

Centennial Corridor Project

Floodplain Evaluation Report

Centennial Corridor from State Route 99 to Interstate 5

City of Bakersfield and Kern County, CA

District 06 - KERN – 58 - PM T31.7 to PM 55.6

District 06 - KERN – 99 - PM 21.2 to PM 26.2

Project ID# 06–0000–0484

November 2012

Caltrans

Floodplain Evaluation Report

Centennial Corridor from State Route 99 to Interstate 5

City of Bakersfield and Kern County, CA

District 06 - KERN – 58 - PM T31.7 to PM 55.6

District 06 - KERN – 99 - PM 21.2 to PM 26.2

Project ID# 06-0000-0484

November **2012**

STATE OF CALIFORNIA

Department of Transportation

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Section 1 Introduction and Project Description

This Floodplain Evaluation Report presents information on baseline conditions related to floodplains within the proposed Centennial Corridor project area and provides a detailed analysis of the Segment 1 alternatives, along with a revalidation of the information provided in the previous environmental documents prepared for Segments 2 and 3.

The report provides data and analysis in support of the Environmental Impact Report/ Environmental Impact Statement for the proposed project prepared pursuant to the California Environmental Quality Act and National Environmental Policy Act. It has been prepared in accordance with the California Department of Transportation (the Department, or Caltrans) Standard Environmental Reference for Floodplain Evaluation Reports. The Standard Environmental Reference applies to all transportation projects developed under the auspices of the Department and to all local agency highway or local streets and roads projects with funding or approvals by the Federal Highway Administration. Caltrans is the California Environmental Quality Act and National Environmental Policy Act lead agency for the proposed project.

1.1 Overview

The California Department of Transportation (Caltrans) proposes to establish a new alignment for State Route 58, which would provide a continuous route along State Route 58 from Cottonwood Road on existing State Route 58, east of State Route 99 (post mile R55.6), to Interstate 5 (I-5) (post mile T31.7). Improvements to State Route 99 (post miles 21.2 to 26.2) and Westside Parkway would also be made to accommodate the connection with State Route 58.

The project is located at the southern end of the San Joaquin Valley in the city of Bakersfield in Kern County, California. The study site is bound on the east by Cottonwood Road, on the west by I-5, on the north by Gilmore Avenue, and on the south by Wilson Road. Caltrans is the lead agency for the project pursuant to the California Environmental Quality Act and the National Environmental Policy Act.

The proposed continuous route, known as the Centennial Corridor, has been divided into three distinct segments, as shown in Figure 1-1.

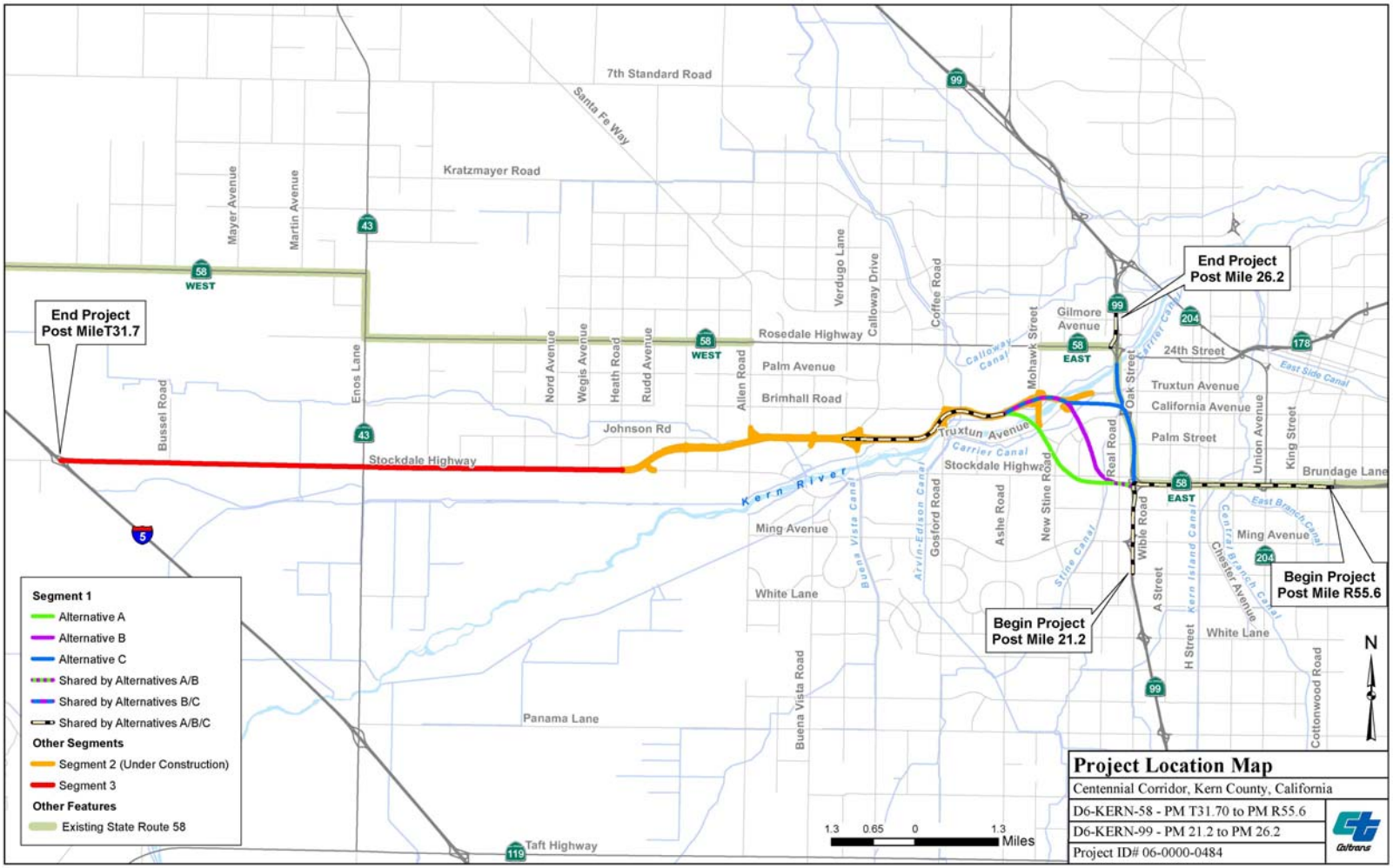


Figure 1-1 Segments of the Centennial Corridor

Segment 1 is the easternmost segment, which would connect the existing State Route 58 (East) freeway to the Westside Parkway. Multiple alignment alternatives are being evaluated for this segment and are discussed below.

Segment 2 is composed of the Westside Parkway, which extends westerly from Truxtun Avenue to Heath Road. This roadway is a local facility that is currently under construction and would be transferred into the State Highway System. The analysis evaluates potential impacts associated with incorporating the Westside Parkway as part of the State Highway System, as well as improvements to the Westside Parkway from Truxtun Avenue to the Calloway Drive interchange which would be made to facilitate traffic operations between the Westside Parkway and the Centennial Corridor. The analysis reports the relevant results of the *Westside Parkway Environmental Assessment/Final Environmental Impact Report* and provides updates, as necessary.

Segment 3 would extend from Heath Road to I-5. This segment will need route adoptions for the use of Stockdale Highway between Heath Road and I-5 as an interim connection for State Route 58. A future new alignment (ultimate) as identified in the 2002 *Route 58 Route Adoption Project Tier I Environmental Impact Statement/Environmental Impact Report* (EIS/EIR) will be constructed when there is greater traffic demand and funding is available. Since traffic would use Stockdale Highway between Heath Road and I-5 on an interim basis, the potential impacts will also be evaluated for the interim use of Stockdale Highway. Improvements to the Stockdale Highway/State Route 43 (known locally as Enos Lane) intersection would be made to accommodate the additional traffic.

1.2 Purpose and Need

The purpose of the Centennial Corridor project is to provide route continuity and associated traffic congestion relief along State Route 58 within Metropolitan Bakersfield and Kern County from State Route 58 east (at Cottonwood Road) to I-5.

State Route 58 is a critical link in the state transportation network that is used by interstate travelers, commuters, and a large number of trucks. Under existing conditions, State Route 58 does not meet the capacity needs of the area, and this is expected to get worse as the population grows. State Route 58 lacks continuity in central Bakersfield, which results in severe traffic congestion and reduced levels of service on adjoining highways and local streets. This route is offset by about 1 mile at State Route 43 and by about 2 miles at State Route 99. The merging of two major state routes (58 and 99) into one alignment between the eastern and western legs of

State Route 58 degrades the traffic level of service on this segment of freeway. In addition, State Route 99's close spacing for its two interchanges with State Route 58 (East and West), in addition to an interchange at California Avenue, results in vehicles aggressively changing lanes, which adds to the congestion.

1.3 Project Description

The project alternatives include three build alternatives and a No-Build Alternative.

1.3.1 No-Build Alternative

No construction of Segment 1 would occur under the No-Build Alternative. In addition, no improvements to the Westside Parkway from Truxtun Avenue to the Calloway Drive interchange would be required. The Westside Parkway would operate as a local roadway, but would not connect to State Routes 58 or 99, or to I-5. State Route 58 (West)/Rosedale Highway would continue to end at State Route 99, where it shares routes with State Route 99 for about 2 miles south to tie into State Route 58 (East). Additionally, there would be no improvements made to the Stockdale Highway/State Route 43 intersection.

1.3.2 Segment 1 Build Alternatives

As shown in Figure 1-2, the three build alternatives (Alternatives A, B, and C) within Segment 1 propose new alignments that would extend from Cottonwood Road on the existing State Route 58 (East) and connect I-5 via the Westside Parkway. Alternatives A and B would be west of State Route 99, and Alternative C would parallel State Route 99 to the west. Under Alternative A, the eastern end of the Westside Parkway mainline would be realigned to conform to the Alternative A alignment, and ramp connections would be provided to the Mohawk Street interchange. Under Alternatives B and C, the alignments would connect to the Westside Parkway by extending the mainline lanes built as part of the Westside Parkway project. Detailed descriptions of the alternatives are provided on the following subsections.

Common Design Features of the Build Alternatives

The build alternatives would connect State Route 58 (East) to the east end of the Westside Parkway by means of a six-lane freeway. All the build alternatives would involve a route adoption to include the selected Segment 1 alignment and the Westside Parkway into the State Highway System as State Route 58. In Segment 3 the route adoption would include the adoption of Stockdale Highway as the interim State Route 58 connection to Interstate 5, as well as the designation of the ultimate

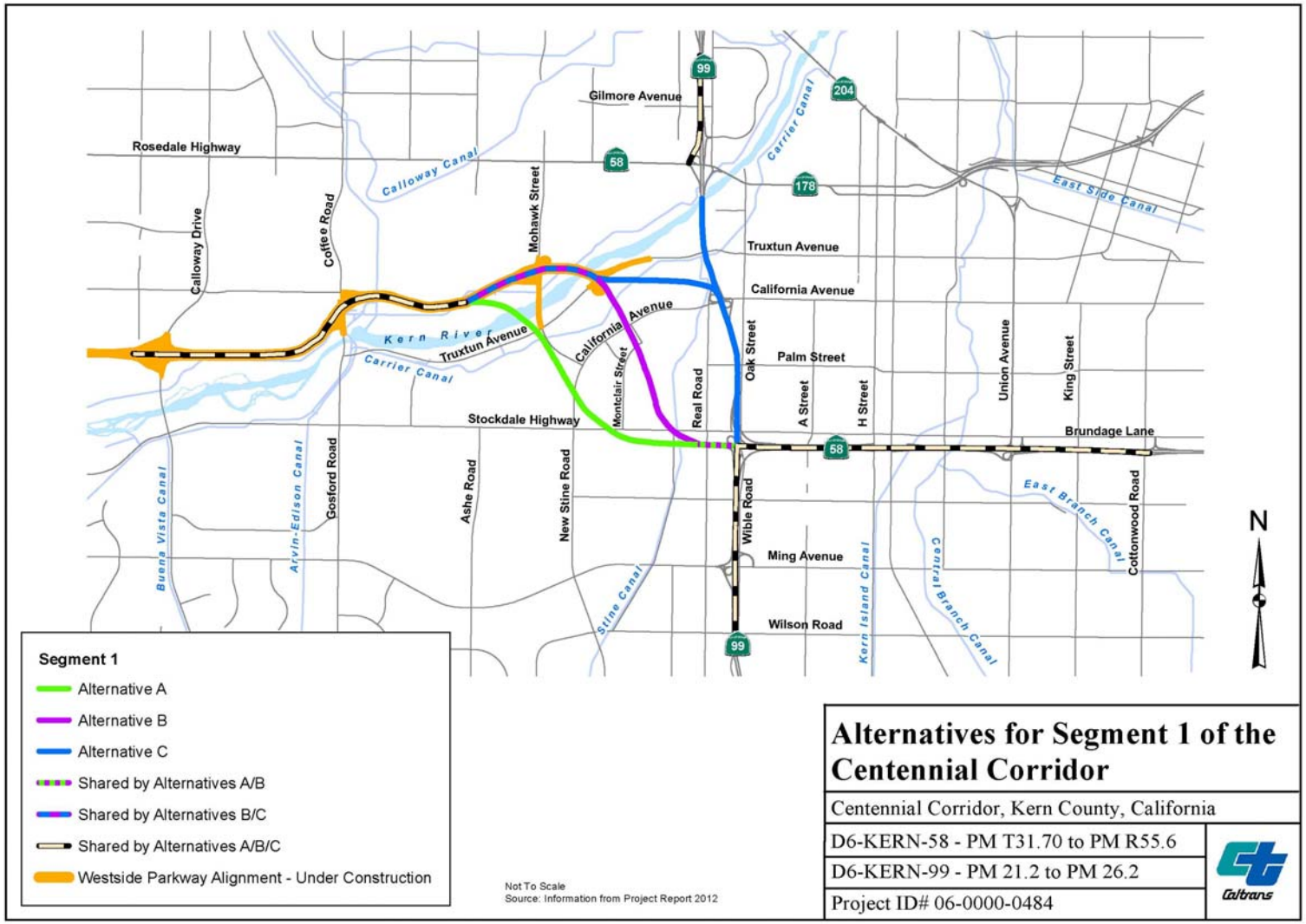


Figure 1-2 Segment 1 of Centennial Corridor

alignment (the Cross Valley Canal alignment addressed in the 2001 EIS/EIR), which would be constructed at a later date. Though the alignment and design characteristics vary by alternative, the three build alternatives have the following common design features:

Segment 1

All the alternatives would provide the following connections between State Route 58 and State Route 99 using high speed connection ramps:

- Northbound State Route 99 to westbound and eastbound State Route 58.
- Southbound State Route 99 to eastbound State Route 58.
- Eastbound State Route 58 to southbound State Route 99.
- Westbound State Route 58 to southbound and northbound State Route 99.

Direct connector ramps from southbound State Route 99 to westbound State Route 58 are not being provided as part of this project. However, to accommodate this movement, the southbound State Route 99/Rosedale Highway off-ramp would have two lanes off the freeway and be widened to four lanes at the intersection with Rosedale Highway. Additionally, an auxiliary lane would be provided on State Route 99 from south of Gilmore Avenue to the State Route 58 (Rosedale Highway) off-ramp. Direct connector ramps from eastbound State Route 58 to northbound State Route 99 are not being provided as part of this project.

The project would require the widening of the South P Street Undercrossing and the westbound State Route 58 Grade Separation over State Route 99. In addition, the Stockdale Highway off-ramp from southbound State Route 99 and the Wible Road on- and off-ramps on State Route 99, located just south of the existing State Route 58/State Route 99 interchange, would be removed.

Segment 2

The Westside Parkway (currently under construction) would be incorporated into the State Highway System with each of the Build Alternatives. Improvements to connect Centennial Corridor to the Westside Parkway would extend from where each build alternative connects at the eastern end of Westside Parkway towards the west ending at the Calloway Drive interchange. The proposed improvements would widen the Westside Parkway by constructing one additional lane in the median to provide auxiliary lanes. In the westbound direction, the median widening would extend from east of the Friant Kern Canal through the Calloway Drive interchange. The limits of the added lane in the eastbound direction would differ between each alternative as

described in the Unique Design Features of the Build Alternatives section below. With each build alternative, modifications to the westbound diamond off-ramp to Calloway Drive and the eastbound loop on-ramp from Coffee Drive would be required.

Though the improvements described above are physically located in Segment 2, construction would be undertaken as part of Segment 1 construction to facilitate traffic operations between the Westside Parkway and the Centennial Corridor.

Segment 3

With each build alternative, the Stockdale Highway/State Route 43 intersection would be widened and traffic signals would be added to control the traffic movements. State Route 43 would be widened to add a dedicated left-turn lane in both directions. Stockdale Highway would be widened to add a dedicated left-turn lane and a shared through/right-turn lane in both directions. Though physically located in Segment 3, these improvements would be built as part of Segment 1 to ensure adequate traffic operations at this intersection.

1.3.2.1 Alternative A

Alternative A would travel westerly from the existing State Route 58/State Route 99 interchange for about 1 mile south of Stockdale Highway, where it would turn northwesterly and go over Stockdale Highway/Montclair Street, California Avenue/Lennox Avenue, Truxtun Avenue, and the Kern River before joining the eastern end of the Westside Parkway near the Mohawk Street interchange.

A link would be provided from northbound State Route 99 to westbound State Route 58 and from eastbound State Route 58 to southbound State Route 99 via high-speed connectors. No direct connector ramps would be built from southbound State Route 99 to westbound State Route 58 or from eastbound State Route 58 to northbound State Route 99. Southbound State Route 99 would be widened to accommodate the additional traffic from eastbound State Route 58 to the southbound State Route 99 connector. The existing westbound State Route 58 to southbound State Route 99 loop-ramp connector would be realigned and would connect to the proposed eastbound State Route 58 to southbound State Route 99 connector before merging onto southbound State Route 99. The existing southbound State Route 99 to eastbound State Route 58 connector and northbound State Route 99 to eastbound State Route 58 would be preserved with some changes.

The limits of widening on State Route 99 would extend to the Wilson Road overcrossing. On northbound State Route 99, a three-lane exit would be provided just north of Wilson Road to carry the northbound State Route 99 to westbound State Route 58 traffic on two lanes and the Ming Avenue on- and off-ramp traffic on the third lane. All ramps in this area would have to be realigned to provide for the additional lanes. The Wible Road on- and off-ramps just south of the existing State Route 58/State Route 99 interchange, which is in conflict with the Caltrans standards of interchange spacing, would have to be removed to accommodate this design. The Stockdale Highway off-ramp on the southbound State Route 99 to eastbound State Route 58 connector would be removed as well. Under this concept, State Route 58 would also lose its link with Real Road. Also, Alternative A would provide an auxiliary lane on southbound State Route 99 from south of Gilmore Avenue to the Rosedale Highway off-ramp.

The median widening to provide an auxiliary lane along the Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp.

Other features with this alternative includes: 1) the construction of 19 soundwalls; 2) construction of a park and ride facility off Mohawk Street, between California Avenue and Truxtun Avenue to replace the facility that would be displaced by the project; 3) seven infiltration basins would be placed throughout the study area to retain stormwater runoff for water quality improvement purposes; and 4) 48 retaining walls of varying sizes located throughout the study area.

The maximum depth of excavation for Alternative A is 25 feet. This would occur near State Route 58 between Stephens Drive and H Street to accommodate the widened ramps. On State Route 99, the maximum excavation would be about 18.5 feet and would occur between Belle Terrace and Ming Avenue.

1.3.2.2 Alternative B

Alternative B would run westerly from the existing State Route 58/State Route 99 interchange to about 1,000 feet south of Stockdale Highway, where it would turn northwesterly and span Stockdale Highway/Stine Road, California Avenue, Commerce Drive, Truxtun Avenue, and the Kern River before joining the east end of Westside Parkway between the Mohawk Street and Coffee Road interchanges. This alignment would depress State Route 58 between California Avenue and Ford Avenue. Overcrossings are proposed at Marella Way and La Mirada Drive to ease traffic circulation.

Alternative B proposes the same connections to State Route 99 that Alternative A does and would require similar improvements on State Route 99 and existing State Route 58.

The median widening to provide an auxiliary lane along the Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp. Modifications would be required to the eastbound Mohawk Street off-ramp, westbound Truxtun Avenue on-ramp and reconstruction of the eastbound Mohawk Street loop on-ramp. In addition, construction of the proposed westbound Mohawk Street off-ramp and realignment of the Cross Valley Canal maintenance access road from Mohawk Street would be required.

Other features with this alternative includes: 1) the construction of 24 soundwalls; 2) construction of a park and ride facility north of California Avenue, next to the Centennial Corridor, to replace the facility that would be displaced by the project; 3) eight infiltration basins would be placed throughout the study area to retain stormwater runoff for water quality improvement purposes; and 4) 42 retaining walls of varying sizes located throughout the study area.

The maximum depth of excavation for Alternative B is 25 feet. This would occur near State Route 58 between Stephens Drive and H Street to accommodate the widened ramps and, between California Avenue and Ford Avenue, where the freeway would be built below the existing grade. On State Route 99, the maximum excavation would be about 18.5 feet, between Belle Terrace and Ming Avenue.

1.3.2.3 Alternative C

Near the existing State Route 58/State Route 99 interchange, Alternative C would turn north and run parallel to the west of State Route 99 for about 1 mile. The freeway would turn west and span the BNSF Railway rail yard, Truxtun Avenue, and the Kern River. This alternative proposes undercrossings at Brundage Lane, Oak Street, State Route 99, Palm Avenue, and California Avenue.

Connections would be provided from eastbound State Route 58 to southbound State Route 99 and from northbound State Route 99 to westbound State Route 58. The existing westbound State Route 58 to southbound State Route 99 loop-ramp connector would connect to the proposed eastbound State Route 58 to southbound State Route 99 connector before merging onto southbound State Route 99. The southbound State Route 99 Ming Avenue off-ramp would be relocated north of the

eastbound State Route 58 to southbound State Route 99 connector to facilitate weaving between the Ming Avenue off-ramp and the eastbound State Route 58 to southbound State Route 99 connector traffic. A connector would be provided east of northbound State Route 99 from Brundage Lane to south of California Avenue to facilitate weaving between westbound State Route 58 to northbound State Route 99 traffic with northbound State Route 99 to westbound State Route 58 traffic.

Improvements on State Route 99 would extend from the Wilson Road overcrossing (south of the State Route 58/State Route 99 interchange) to the Gilmore Avenue overcrossing (north of the State Route 58/State Route 99 interchange). A collector-distributor (C-D) road system would provide access from westbound State Route 58 to northbound State Route 99, as well as from northbound State Route 99 to westbound State Route 58. The Wible Road on- and off-ramps just south of the existing State Route 58/State Route 99 interchange would have to be removed to accommodate the northbound State Route 99 auxiliary lane. The Stockdale Highway off-ramp on the southbound State Route 99 to eastbound State Route 58 connector would be removed as well. Under this concept, southbound State Route 99 would also lose its link with Real Road.

The median widening to provide an auxiliary lane along Westside Parkway would extend westerly from the connection point with Centennial Corridor between Coffee Road and Mohawk Street to the Coffee Road off-ramp. Modifications would be required to the eastbound Mohawk Street off-ramp, westbound Truxtun Avenue on-ramp and reconstruction of the eastbound Mohawk Street loop on-ramp. In addition, construction of the proposed westbound Mohawk Street off-ramp and realignment of the Cross Valley Canal maintenance access road from Mohawk Street would be required.

Other features with this alternative includes: (1) the construction of 17 soundwalls; (2) construction of a park and ride facility at Real Road and Chester Lane to replace the facility that would be displaced by the project; (3) eleven infiltration basins would be placed throughout the study area to retain stormwater runoff for water quality improvement purposes; and (4) 42 retaining walls of varying sizes located throughout the study area.

The maximum depth of excavation for Alternative C is 25 feet. This would occur near State Route 58 between Stephens Drive and H Street to accommodate the widened ramps. On State Route 99, the maximum excavation would be about 18.5 feet and be located between Belle Terrace and Brundage Lane.

Section 2 Unique Design Features of Build Alternatives

As described in Chapter 1, three Segment 1 build alternatives are being considered to connect SR 58 (East) to Westside Parkway (Segment 2). All three alternatives, aligned as shown in Figure 1-2, would be designed with three 12-foot-wide lanes in each direction separated by a 26-foot-wide median, though a lesser median width is proposed in some spots due to right-of-way restrictions.

2.1 Alternative A

This alternative crosses the Arvin Edison Canal, Friant-Kern Canal, Cross Valley Canal east of Coffee Road, the Kern River, Carrier Canal west of Mohawk Street, and Stine Canal just south of Stockdale Highway, as shown in Figure 2-3. A photo of the existing railroad bridge over the Kern River just upstream of the proposed project is shown in Figure 2-1. The profile of the existing bridge over the Kern River is shown in Figure 2-2.

Figure 2-1 Existing Railroad Bridge over the Kern River

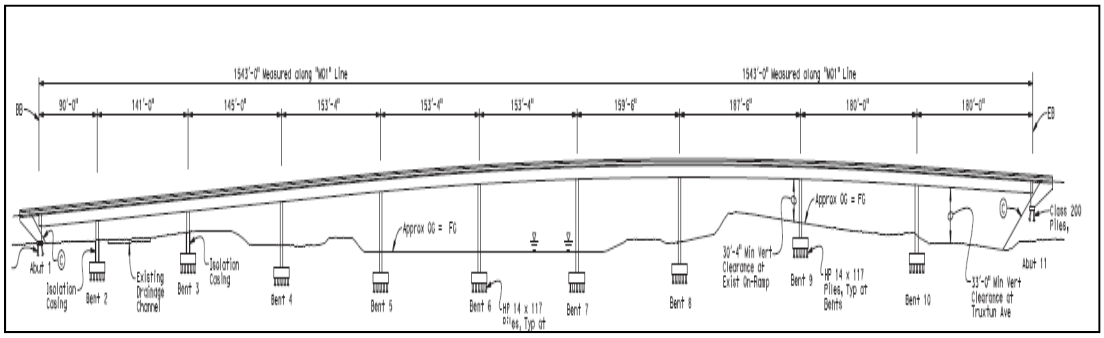


Figure 2-2 Profile of Existing Bridge over the Kern River

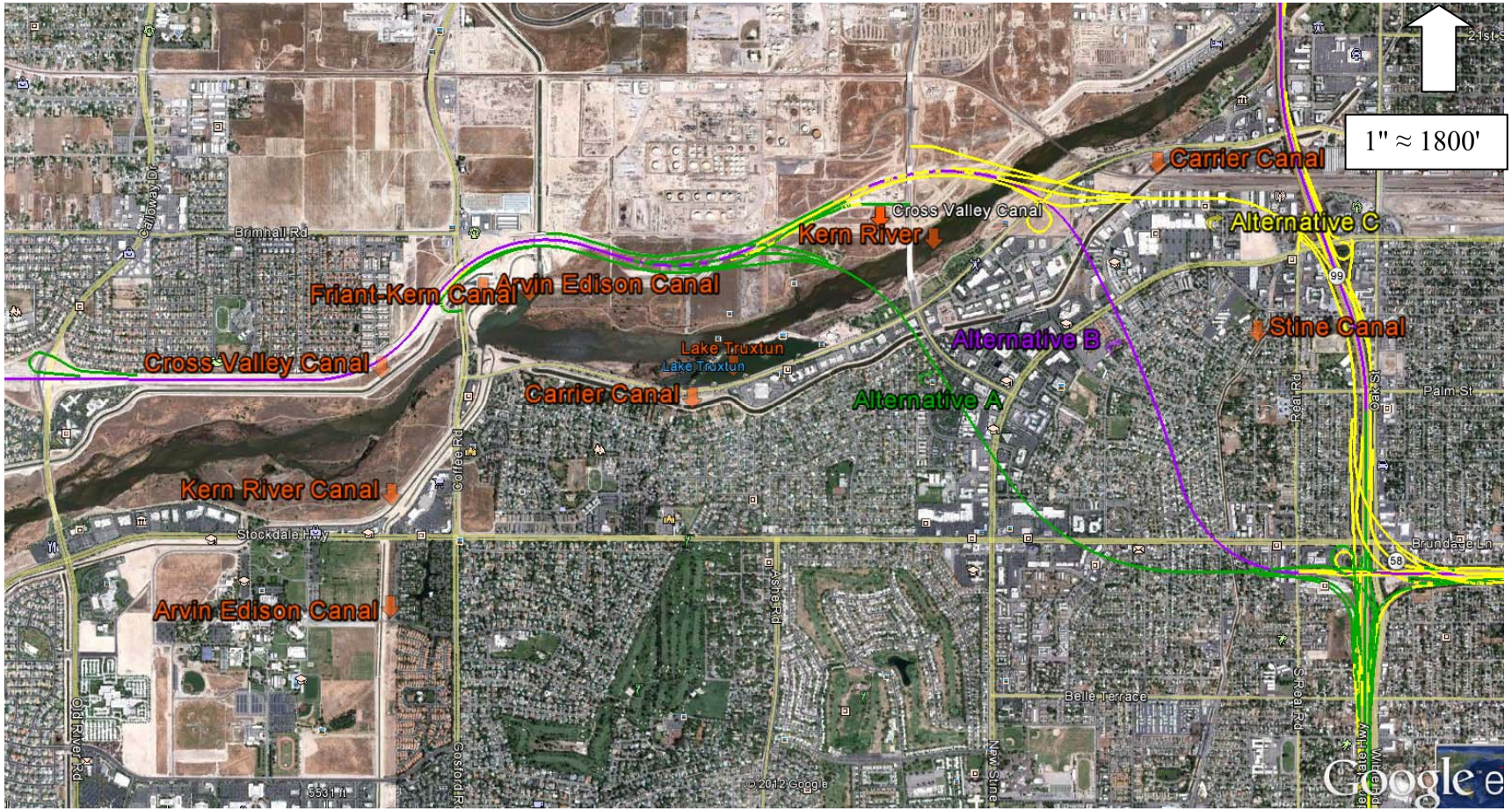


Figure 2-3 Segment 1 Crossings of Major Waterways by Alternative

The existing bridge over the Friant-Kern Canal would be replaced by a 172-foot-long bridge. The profile of the bridge over the canal is shown in Figure 2-4. An 855-foot-long box girder bridge with five piers is proposed over the Kern River. The profile of the bridge over the Kern River is shown in Figure 2-5. The bridge spans vary in length from 110 feet to 160 feet.

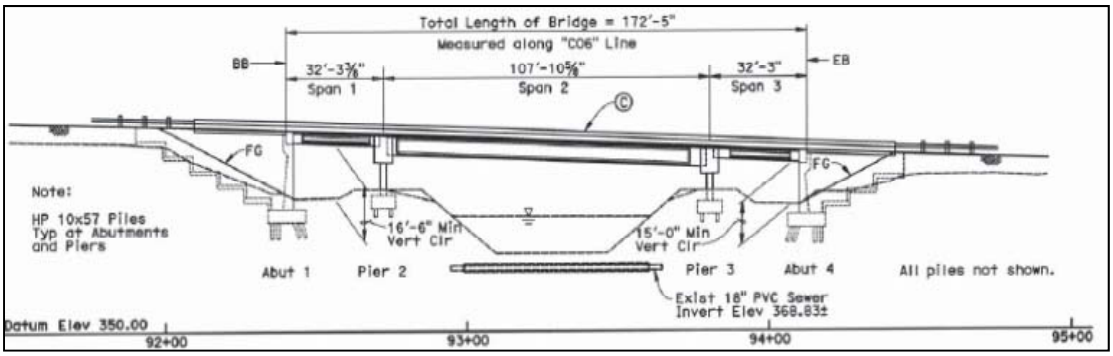


Figure 2-4 Profile of Proposed Bridge over the Friant-Kern Canal

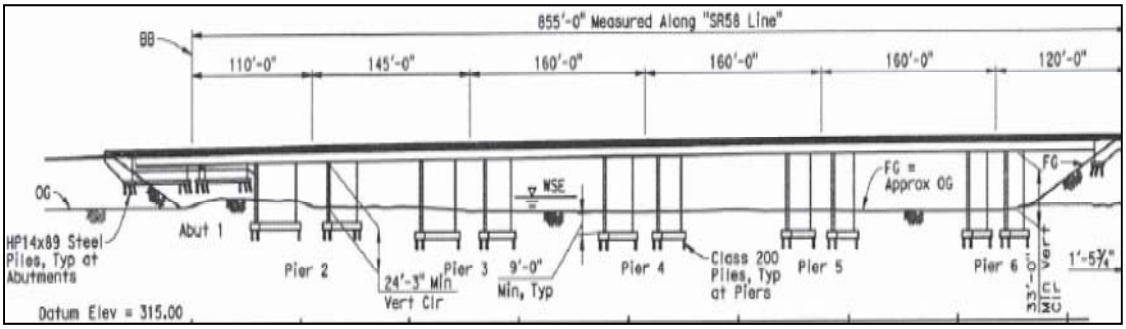


Figure 2-5 Profile of Proposed Bridge over the Kern River (Alternative A)

2.2 Alternative B

This alternative runs along the Cross Valley Canal from Calloway Drive to Coffee Road, crossing the Friant-Kern Canal, Cross Valley Canal east of Coffee Road, and the Kern River and Carrier Canal between Mohawk Street and the existing BNSF railroad, over the Kern River and Stine Canal just south of Stockdale Highway, as shown in Figure 2-3.

Alternative B proposes a 941-foot-long bridge off-ramp connecting westbound SR 58 to Mohawk Street. The profile for this bridge is shown in Figure 2-6, and the plan is shown in Figure 2-7. Alternative B also includes a new 677-foot-long mainline bridge that would allow the SR 58 mainline bridge to be widened over the Kern River, as shown in Figure 2-7. The profile is shown in Figure 2-8.

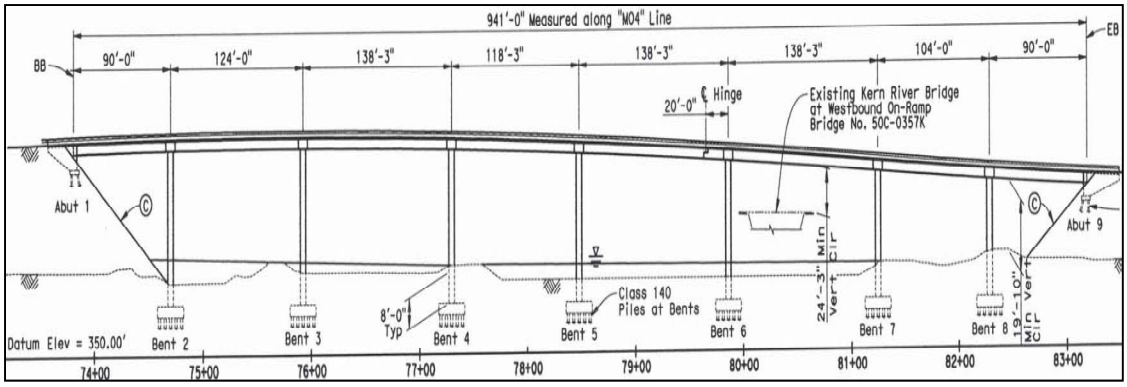
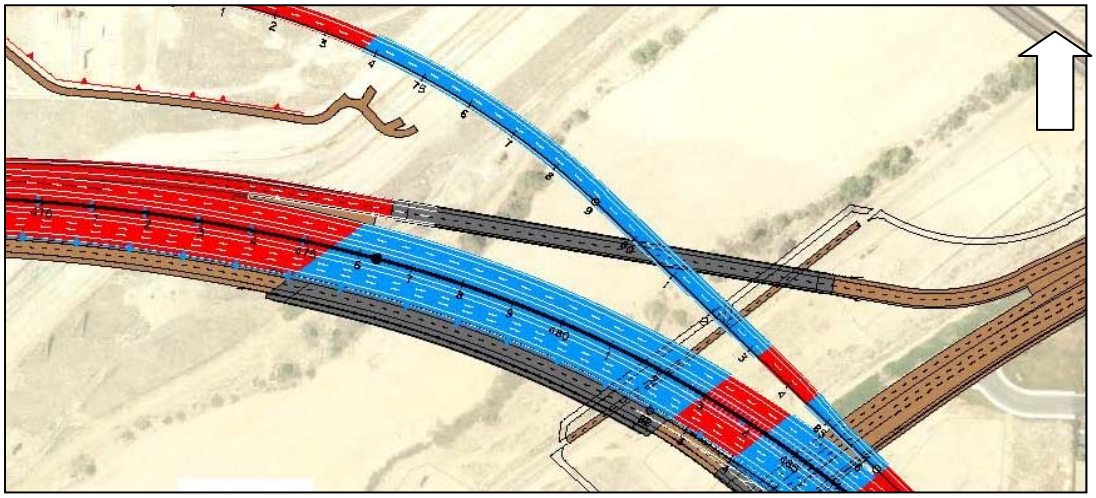


Figure 2-6 Profile of Bridge at Mohawk Street (Alternative B)



Note: Brown/Gray shades = existing roadways/structures; Red shades = proposed roadways; Blue shades = proposed structures

Figure 2-7 Kern River Bridge Widening and Westbound SR 58 Off-Ramp (Alternative B)

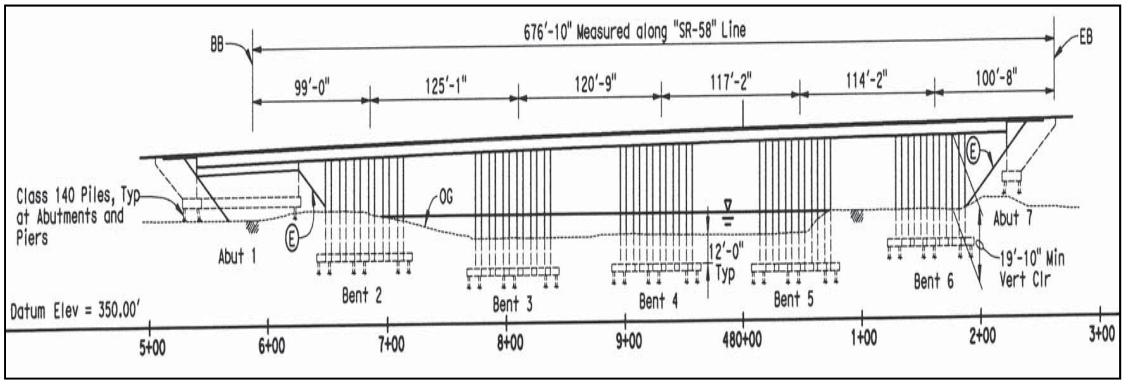
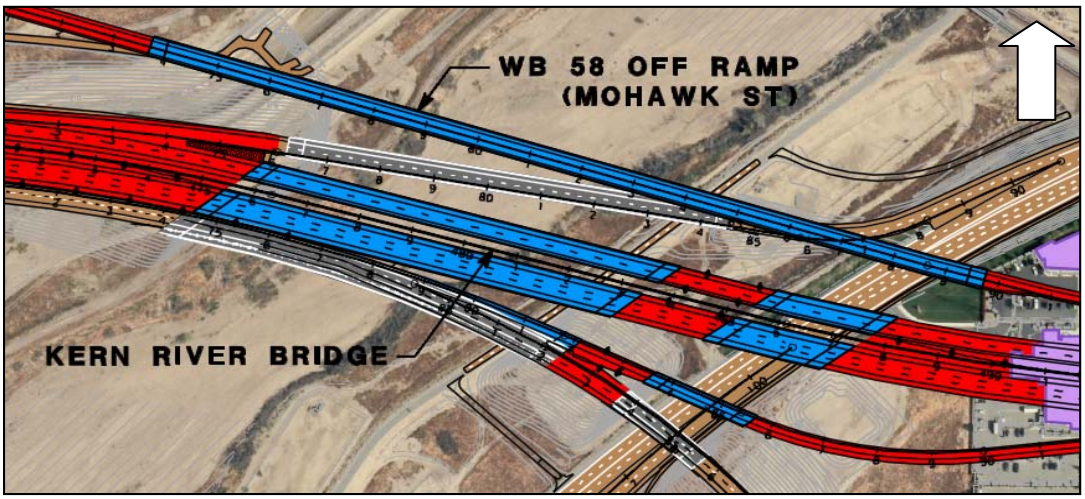


Figure 2-8 Profile of Bridge Widening over the Kern River (Alternative B)

2.3 Alternative C

This alternative runs along the Cross Valley from Calloway Drive to Coffee Road, crosses the Friant-Kern Canal and Cross Valley Canal east of Coffee Road, and crosses the Kern River and Carrier Canal between Mohawk Street and the existing railroad over the Kern River, as shown in Figure 2-3. Alternative C also crosses the Kern Island Canal and Central Branch Kern Island Canal, as shown in Figure 2-9.

Alternative C proposes a bridge off-ramp connecting westbound SR 58 to Mohawk Street, as shown in Figure 2-9. Alternative C also proposes a new 737-foot-long mainline bridge that would allow the SR 58 mainline to be widened at the Kern River, as shown in Figure 2-9. The profile is shown in Figure 2-10.



Note: Brown/Gray shades = existing roadways/structures; Red shades = proposed roadways; Blue shades = proposed structures

Figure 2-9 Kern River Bridge Widening and Westbound SR 58 Off-Ramp (Alternative C)

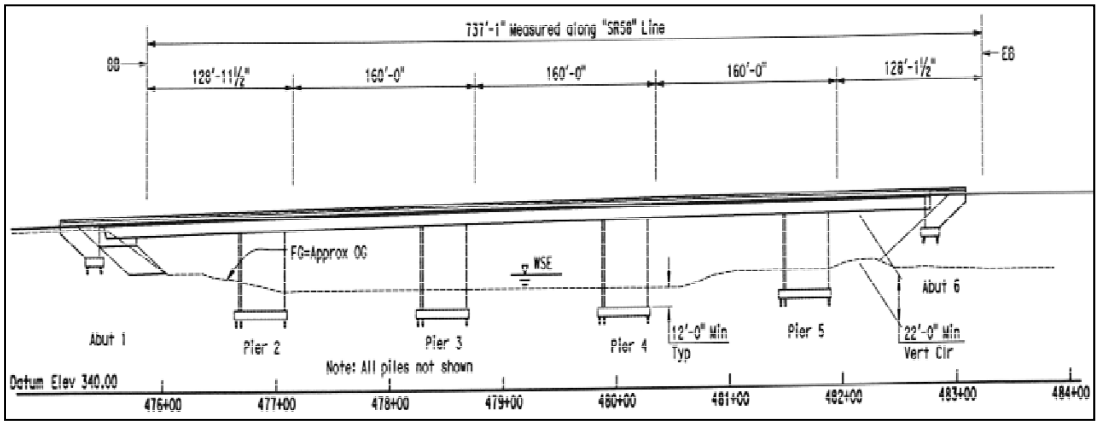


Figure 2-10 Profile of Bridge Widening over the Kern River (Alternative C)

Section 3 Environmental Setting

The existing environmental setting with regard to hydraulics is described in this chapter. The general topography of the surrounding area consists mostly of flat land with sparse ridges and manmade berms. Runoff during rains generally flows from northeast to southwest, parallel to the Kern River via sheet flow. Runoff is intercepted by drainage ditches or inlets connected to a storm drain system that conveys the flow to existing vegetated swales and/or infiltration and retention basins.

3.1 Kern River Watershed

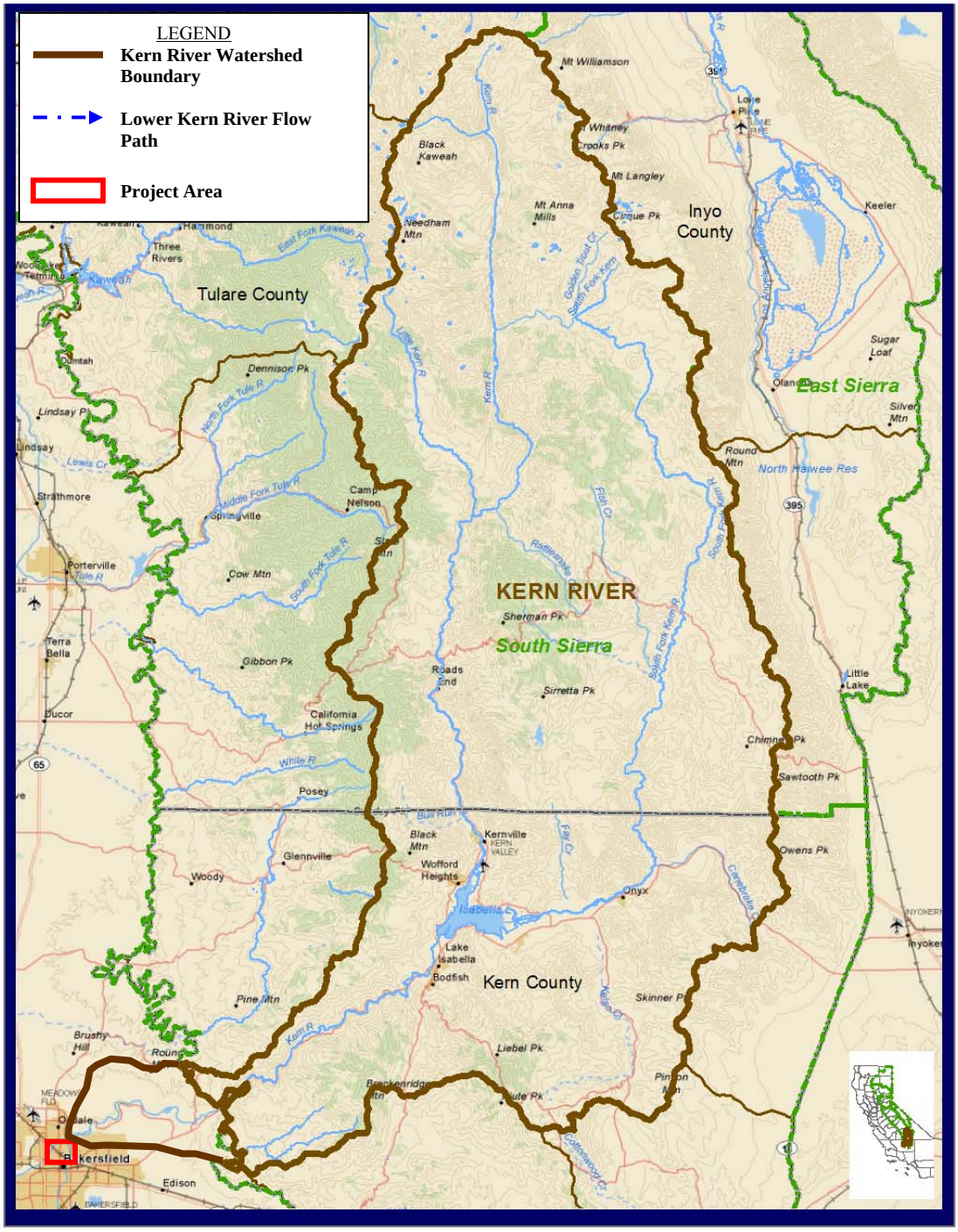
The project site is located in the Kern River watershed, as shown in Figure 3-1. The "upper" Kern River originates in the southern Sierra Nevada mountains. The watershed runoff flows south through the Sequoia National Forest and enters the Lake Isabella Reservoir, created by the Lake Isabella Dam. The "lower" Kern River originates from the flows immediately downstream of the dam. The Kern River flows southwest and continues collecting runoff from the Greenhorn Mountains, before entering the flat land of the San Joaquin Valley approximately 6.5 miles upstream of the project site. The major river crossing in the project reach is the Kern River, which is a designated regulatory floodway that flows in a broad channel with meandering thalweg[2].

The Kern River watershed at the project site is approximately 2,500 square miles; this estimate is based on a watershed area of 2,407 square miles at U.S. Geological Survey Gauge 11194000, located approximately 9 miles upstream on the Kern River (USGS 2008). Lake Isabella Dam controls 2,074 square miles of the Kern River watershed; the dam is located approximately 53 miles upstream from the project site (FEMA 1984). The remaining 426 square miles in the watershed is partially controlled by the three irrigation canal diversion structures upstream of the proposed bridge locations in Bakersfield.

3.2 Existing Floodplain Characteristics

Properties surrounding the river in the project vicinity are protected by levees. The Kern River flows near residential developments, parks, a golf course, and the campus of California State University, Bakersfield. Most of these areas are located outside of the 100-year floodplain.

[2] A thalweg is defined as a line drawn to join the lowest points along the entire length of a streambed or valley in its downward slope, defining its deepest channel.



Base Map Source: Sierra Nature Conservancy

Figure 3-1 Kern River Watershed Area at the Project Location

The Federal Emergency Management Agency conducted hydrologic and hydraulic analyses of the Kern River in 2008 to determine the extent and severity of flooding for Bakersfield. The results are presented in the Federal Emergency Management Agency's 1984 Flood Insurance Study of the City of Bakersfield. The peak flow rates associated with the 10-, 50-, 100-, and 500-year return period events, used by the Central Valley Flood Protection Board for this section of the Kern River, are listed below in Table 3.1.

Table 3-1 Kern River Flood Peak Discharges

Return Period (years)	Annual Probability of Exceedance	Peak Discharge Rate (cubic feet per second)
10	0.10	2,800
50	0.02	7,000
100	0.01	15,000
500	0.002	30,000

Source: Parsons, 2009.

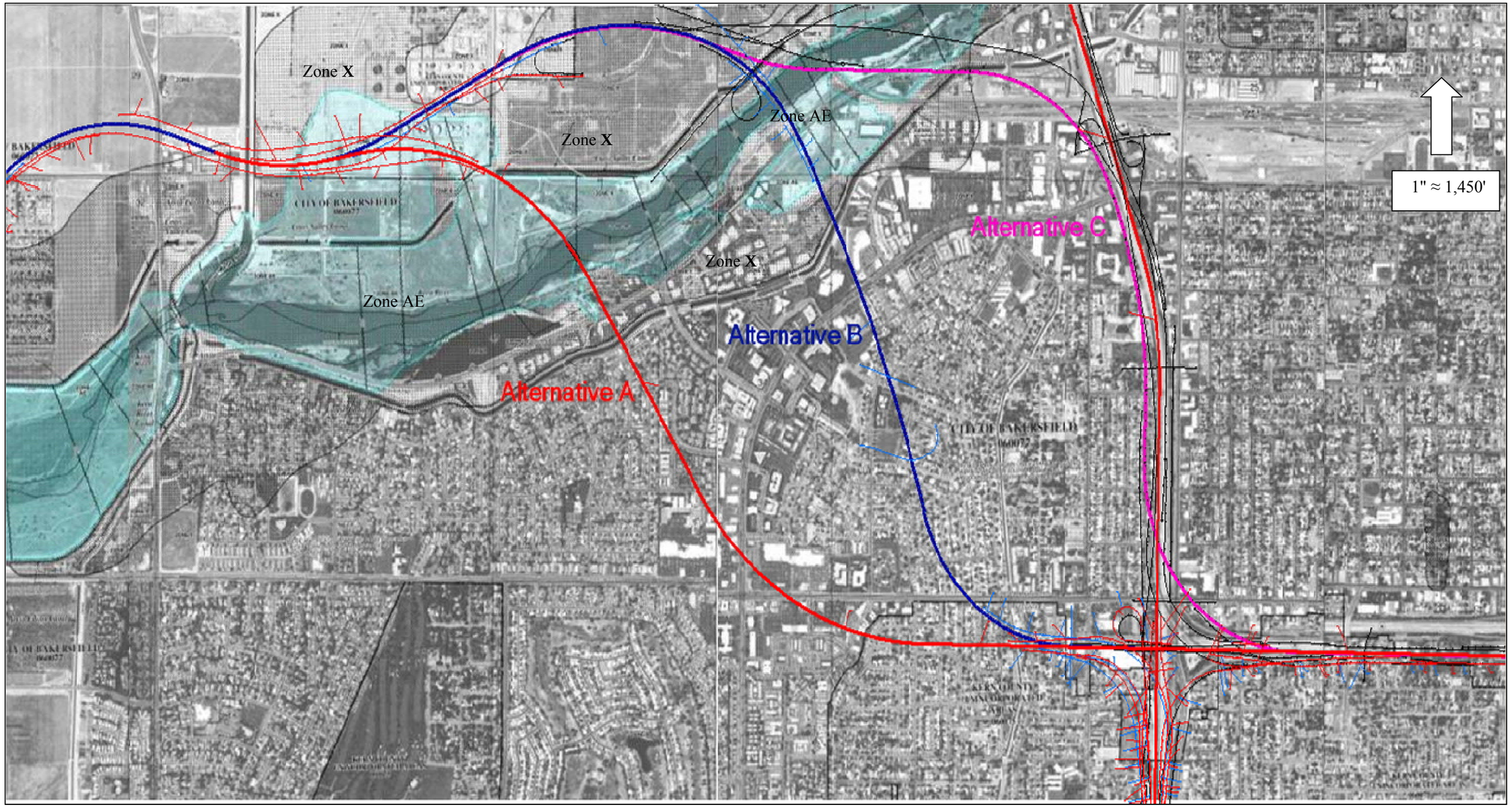
The 100-year floodplain, as developed by the Federal Emergency Management Agency, was adopted on the Federal Emergency Management Agency Flood Insurance Rate Map, dated 1985. The floodway limits were developed by artificially encroaching upon the existing 100-year floodplain to cause a 0.3-meter (1.0-foot) increase of the water surface. Floodways were created in major rivers for the purpose of providing a regulatory guidance of floodplain development and maintaining a minimum flood corridor under natural conditions.

The Kern River 100-year and 500-year floodplains occur within the project area for all segments of the Centennial Corridor Project. Flood control measures currently in place along the Kern River in the project vicinity include flood control levees on both sides of the river, the Coffee Road Bridge, a diversion structure upstream of Coffee Road, and the Carrier Canal and adjacent levees. All of these improvements are designed to provide flood protection.

3.3 Federal Emergency Management Agency Floodplain Designations

Federal Emergency Management Agency maps display areas within the project limits that cross flood hazard zones designated X and AE. These zones are shown in Figure 3-2, with the green-shaded areas indicating Zone AE. Zone X is designated by the Federal Emergency Management Agency for areas protected from the 100-year flood event by levees that prevent overtopping of adjacent flood channels. Areas identified as Zone AE are designated by the Federal Emergency Management Agency

as a flood insurance rate zone having a 1 percent chance of being exceeded in a given year.



Note: Zone AE = areas that are subject to flooding by the 100-year flood event, and base flood elevations are shown; Zone X = areas protected from the 100-year flood event by levees that prevent overtopping of adjacent flood channels
Source: Google Earth and FEMA

Figure 3-2 Kern River Flood Hazard Zones across Alignment Alternatives A, B, and C

Section 4 Impact Assessment

4.1 Approach

In accordance with the "Content and Recommended Format" for technical studies, as established in the Standard Environmental Reference, this report addresses the following:

- *Risk Assessment*: Includes an overview of the regulatory floodplain within the project area.
- *Impacts of the Project*: Includes an assessment of direct impacts, impacts to natural floodplain values, support of incompatible floodplain development, and the potential for interruption or termination of the transportation facility in the event of flooding.
- *Measures to Minimize Impacts*: Recommends minimization measures to decrease potential impacts on the regulatory floodplain.

For the floodplain impact analysis, an HEC-RAS hydraulic model was prepared to calculate the Water Surface Elevation in the river under existing conditions and for the three proposed alternatives using the 100-year storm event. The results of each model run are provided in Appendix A.

4.2 Project Design Features

4.2.1 Design Standard

The project would create a new section of highway and its underlying substructure. The storm water runoff from the proposed roadways would be conveyed through a series of new drainage facilities. In accordance with Caltrans standards (Central Region Hydraulic Design Criteria), proposed drainage facilities would be designed for a 25-year, 5-minute storm event, and basins would be designed for two 10-year, 24-hour storm events. The Central Valley Flood Protection Board adopted the Federal Emergency Management Agency's '1981 Interim Levee Policy and Issuance of 44 CFR 65.10', requiring a minimum of 3-feet of freeboard, "with provisions for exceptions for lower freeboard where the applicant demonstrated a lower level of uncertainty" (Interagency Levee Policy Review Committee 2006).

4.2.2 Proposed Drainage Pattern

The project would increase impervious area within the project limits, resulting in an increase in the velocity and the volume of storm water runoff. Runoff from short

segments of roadway would sheet flow to the edge of roadway and discharge to existing and proposed drainage inlets. A series of additional drainage inlets would be designed and located based on the roadway geometric features to collect the runoff. These additional inlets would convey runoff to the system outfalls that ultimately discharge to proposed retention basins.

Flared end sections and energy dissipation devices would be used at the outlets of proposed facilities for erosion control. Several existing drainage facilities would be improved or rerouted to new infiltration/retention basins as a result of the project. Existing cross culverts would be extended where pavement widening is required, and drainage inlets would be relocated along the pavement shoulder. Drainage design would be finalized in the plans, specifications, and estimate phase of the project.

4.3 Impact to Drainage Patterns

Results from the HEC-RAS modeling are discussed below by alternative. The water surface elevations for existing conditions and proposed bridge alternatives are summarized in Table 4-1. The table shows water surface elevations at the cross sections used in the HEC-RAS model, located both upstream and downstream of the proposed bridges. Cross sections are shown in Appendix A, which also includes the HEC-RAS modeling results for the 100-year storm event under existing and proposed conditions and for each build alternative.

4.3.1 Hydraulic Analysis for Alternative A

Alternative A proposes a new bridge over the Kern River as discussed in Section 2.1. Improvements proposed at this location include a concrete bridge supported on piers and abutments built within the Zone AE floodplain of the river. The 100-year peak discharge flow rate of 15,000 cubic feet per second, as shown in Table 3-1, was used for the analysis. The HEC-RAS model results indicate that the maximum increase in the 100-year water surface would be 0.46-foot for Alternative A. At River Station 1271, the existing Water Surface Elevation at the upstream side of the proposed crossing location is 390.17 feet (NAVD 88), and the proposed Water Surface Elevation at the upstream side would be 390.63 feet (NAVD 88).

Table 4-1 Water Surface Elevations and Levee Freeboard

Station	Water Surface Elevation (100-Yr)				Change in Water Surface			Levee Elevation		Existing Levee Freeboard		Levee Freeboard with Improvements (Minimum)	
	Existing (ft)	Alt A (ft)	Alt B (ft)	Alt C (ft)	Alt A (ft)	Alt B (ft)	Alt C (ft)	Left (ft)	Right (ft)	Left (ft)	Right (ft)	Left (ft)	Right (ft)
2950	395.1	395.12	395.17	395.2	0.07	0.07	0.1	402.29	400.45	8.9	7.1	8.8	7
2650	394.67	394.69	394.75	394.79	0.08	0.08	0.12	402.17	399	9.1	6	9	5.9
2485	394.63	394.65	394.71	394.75	0.08	0.08	0.12	402.14	398.84	9.2	5.9	9.1	5.8
2389	394.62	394.63	394.70	394.73	0.08	0.08	0.11	402.77	400.98	9.8	8	9.7	7.9
2143	394.46	394.47	394.54	394.58	0.08	0.08	0.12	399.82	398.66	7	5.8	6.9	5.7
1812	393.84	393.91	393.99	393.99	0.15	0.15	0.15	399.30	397.20	7	4.9	6.9	4.8
Westbound Off-Ramp to Mohawk (Alternatives B and C)													
1558	393.59	393.7	393.71	393.69	0.11	0.12	0.1	399.28	398.04	7.2	5.9	7.1	5.8
1498	393.48	393.58	393.60	393.57	0.1	0.12	0.09	398.90	397.10	6.9	5.1	6.8	5
Centennial Corridor (Alternatives B and C)													
1224	392.47	392.64	392.47	392.47	0.17	0	0	398.63	395.20	7.3	3.9	7.1	3.7
701	391.91	392.14	391.91	391.91	0.23	0	0	397.83	397.41	7	6.6	6.8	6.4
0	391.43	391.72	391.43	391.43	0.29	0	0	395.88	396	5.4	5.5	5.1	5.2
-446	391.12	391.45	391.12	391.12	0.33	0	0	396.26	396.08	6	5.8	5.7	5.5
-971	390.75	391.12	390.75	390.75	0.37	0	0	396.04	396.02	6	6	5.6	5.6
-1121	390.32	390.74	390.32	390.32	0.42	0	0	396.38	395.16	6.6	5.4	6.2	5.0
-1271	390.17	390.63	390.17	390.17	0.46	0	0	395.62	394.86	5.9	5.2	5.4	4.7
-1471	390	390.35	390	390	0.35	0	0	395.64	394.46	6.1	4.9	5.7	4.5
Centennial Corridor (Alternative A)													
-1971	389.68	389.69	389.68	389.68	0.01	0	0	394.67	393.46	5.3	4	5.3	4
-2471	389.38	389.38	389.38	389.38	0	0	0	394.14	393.19	4.9	3.9	4.9	3.9
-2871	389.17	389.17	389.17	389.17	0	0	0	393.62	392.63	4.5	3.5	4.5	3.5

Source: Parsons

4.3.2 Hydraulic Analysis for Alternative B

Alternative B proposes a new bridge off-ramp connecting westbound SR 58 to Mohawk Street and a bridge widening to the north of the SR 58 mainline bridge over the Kern River, within the Zone AE floodplain as discussed in Sections 2.2 and 3.3. As with Alternative A, a 100-year peak discharge flow rate of 15,000 cubic feet per second was also used for the analysis. The HEC-RAS model results indicate that the maximum increase in the 100-year water surface would be 0.15-foot for Alternative B. At Station 1812, the existing Water Surface Elevation at the upstream side of the proposed crossing location is 393.84 feet (NAVD 88), and the proposed Water Surface Elevation at the upstream side would be 393.99 feet (NAVD 88).

4.3.3 Hydraulic Analysis for Alternative C

Alternative C proposes a new bridge off-ramp connecting westbound SR 58 to Mohawk Street and a new SR 58 bridge to the north of the Westside Parkway bridge within the Kern River, as discussed in Section 2.3. Improvements proposed at this location include concrete bridges supported on piers and abutments (see Appendix A) built within the Zone AE floodplain of the river. Like the other alternatives, a peak-discharge flow rate of 15,000 cubic feet per second was used for the analysis. The HEC-RAS model results indicate that the maximum increase in the 100-year water surface would be 0.15-foot for Alternative C. At Station 1812, the existing Water Surface Elevation at the upstream side of the proposed crossing location is 393.84 feet (NAVD 88), and the proposed Water Surface Elevation at the upstream side would be 393.99 feet (NAVD 88).

4.4 Impact to Floodplain

4.4.1 Risk Assessment

The Kern River 100-year and 500-year floodplains occur within the project area for all segments of the Centennial Corridor Project. Flood control measures currently in place along the Kern River in the project vicinity include flood control levees on both sides of the river, the Coffee Road bridge, a diversion structure upstream of Coffee Road, and the Carrier Canal and adjacent levees. All of these improvements have been designed to provide flood protection in Bakersfield.

In a 2008 Flood Insurance Study (FIS), the Federal Emergency Management Agency (FEMA) conducted hydrologic and hydraulic analyses of the Kern River to determine the extent and severity of flooding for the City of Bakersfield (FEMA, 2008). The Kern River is also under the jurisdiction of the Central Valley Flood Protection Board

(CVFPB) as a designated floodway. Any increase in water surface elevation due to proposed improvements within the floodway must be approved by FEMA and the CVFPB.

4.4.2 Floodplain Boundary Impacts

The 100-year and 500-year flood elevations have been mapped by the Federal Emergency Management Agency, as shown in Figure 3-2. Potential impacts to floodplain boundaries are described in the following paragraphs for Segment 1. Floodplain boundary impacts for Segments 2 and 3 are discussed in Appendix B.

As shown in Figure 3-2, Alternatives A, B, and C of Segment 1 are located within Flood Hazard Zone X (an area that is determined to be outside the 100- and 500-year floodplains), west of the Kern River (at approximate station 418+00). From stations 418+00 to 437+00, the alternatives encroach into an overflow area of the 100-year floodplain. This overflow area is considered an ineffective flow area that temporarily ponds north of the Cross Valley Canal. Because this area is not within the main flow path of the Kern River floodplain, improvements within this area do not have an effect on the river's hydraulic characteristics at peak flow.

For areas located east of station 437+00, the alignments cross the Kern River Zone AE Floodplain at various locations as identified below:

Alternative A: From STA 437+00 to STA 465+00, this alignment is located within the Zone AE Floodplain of the Kern River. Farther to the east, from STA 465+00 to STA 473+00, this alignment is located within Flood Hazard Zone X.

Alternative B: From STA 437+00 to STA 488+00, this alignment is located within Flood Hazard Zone X. From STA 488+00 to STA 501+00, Alternative B is located within the Zone AE Floodplain of the Kern River. Farther to the east, from STA 501+00 to STA 506+00, this alignment is within Flood Hazard Zone X.

Alternative C: From STA 437+00 to STA 491+00, this alignment is located within Flood Hazard Zone X. From STA 491+00 to STA 501+00, Alternative C is located within the Zone AE Floodplain of the Kern River. Farther to the east, from STA 501+00 to STA 506+00, this alignment is within Flood Hazard Zone X.

As illustrated in Sections 2.1, 2.2, and 2.3, the crossings are expected to have multiple bridge piers and abutments that would parallel the direction of flow to minimize obstructions to flow conveyance. Pursuant to state regulations, the bridges would be

designed to have sufficient freeboard above the 100-year flood Water Surface Elevation. Hydraulic modeling results show that the bridge decks for all of the proposed alternatives would not impact flood flows.

As discussed in Sections 4.3.1, 4.3.2, and 4.3.3, the alternatives would cause increases to the Water Surface Elevations; changes to elevations for the 100-year storm event would range from zero to 0.46-foot for Alternative A and from zero to 0.15-foot for Alternatives B and C. Any increase in water surface elevation due to proposed improvements within the floodway must be approved by the CVFPB. Even though the increases in water surface will not encroach on the mandated levee freeboard, the CVFPB must still be consulted regarding any potential water surface increase during the final design phase and may require incorporation of additional measures for minimizing or avoiding water level changes.

As discussed above, levees are located along both sides of the Kern River. These levees help to protect Bakersfield from potential flood hazards. the National Flood Insurance Program-mandated freeboard criteria for levees to be recognized as flood protection features are as follows: (1) the levees must pass the Federal Emergency Management Agency base flood with a minimum of 3-feet of freeboard, and (2) within 100 feet of structures, such as bridges, the levee must protect an additional 1-foot of freeboard above the base flood elevation. Although the alternatives produce increases in Water Surface Elevation along the Kern River, freeboard along both levees would not be greatly affected. As shown in Table 4-1, model results show that for each alternative, the project levee freeboard for the 100-year design flow would be greater than 3-feet (the mandated freeboard limit). However, further communication regarding any water surface increases resulting from project implementation will be required with CVFPB to obtain approval during the design phase of the project.

4.4.3 Impacts to Natural Floodplain Values

Natural and beneficial uses of the Kern River channel and adjacent floodplain include wildlife foraging, migration, and breeding; flood flow conveyance and storage; groundwater recharge; and recreational activities. Even with surrounding urbanization, the Kern River channel and adjacent floodplain have moderate wildlife habitat values.

Habitat loss with implementation of any build alternative would not alter the beneficial use of the Kern River floodplain by wildlife. This is because the amount to be removed is minimal, with a maximum of .01-acre permanent wetland loss for

Alternative C and no loss for Alternatives A and B. Permanent loss of up to 0.13-acre non-wetland Waters of the United States with Alternative A (zero for the other alternatives) would not be considered critical to the survival of populations of species inhabiting the area. Small temporary and permanent losses of riparian habitat would be offset by developing replacement habitat and other measures as outlined in the Natural Environment Study for this project. In addition, the bridges would be designed to not impede the use of the floodplain as a movement corridor for wildlife.

The proposed Segment 1 bridge alternatives across the Kern River would not substantially alter the habitat for any fish. Bridge piers would occupy a small space (varying from approximately 1,060 square feet to 2,085 square feet, depending on the alternative) relative to the river channel bottom area. The area under the bridge decks that would be shaded varies from approximately 1.8 acres to 3.1 acres of the riverbed, depending on the alternative. Neither the piers nor the shading would alter the population size of any fish inhabiting the river or affect wildlife foraging, migration, and breeding.

The Kern River channel is important for recharge of the groundwater aquifer. Bridge piers would occupy a cumulative area varying from approximately 0.02- to 0.05-acre (depending on the alternative) of the channel floor, thus reducing the area available for recharge; however, the amount of channel bottom occupied by impermeable concrete piers would be too small to measurably change the amount of recharge provided by the river channel.

4.4.4 Support of Incompatible Floodplain Development

The proposed project would neither provide any new access to the Kern River floodplain, nor significantly change the water surface elevations of the 100-year flood; therefore, the build alternatives, as proposed, would not support incompatible floodplain development.

4.4.5 Potential for Interruption or Termination of a Transportation Facility in the Event of Flooding

As described in Section 4.4.2, the entire road surface would be designed above the 100-year floodplain. The project would not substantially alter Water Surface Elevations of the 100-year flood; therefore, it would not affect the potential for interruption or termination of a transportation facility in the event of flooding.

Section 5 Measures to Minimize Floodplain Impacts

This floodplain evaluation has considered the effects of the build alternatives in terms of encroachment, interruption, risk, and impacts to natural resources. The following conclusions have been reached based on the Chapter 4 analysis:

- A significant floodplain encroachment does not exist.
- There is no significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles.
- There is low risk associated with encroachment, migration interruption, and other impacts to natural resources.
- There would be no significant impacts on natural and beneficial floodplain values.

Although the proposed project would not have significant floodplain impacts, the following measures are expected to minimize any impacts:

- Storm water runoff would be collected and stored in retention basins.
- Project design elements would include incorporation of bridge piers and abutments paralleling the direction of flow to minimize flow obstruction.
- Pier placement would be optimized to align the proposed piers with existing piers in the Kern River.
- Bridge abutments would be located outside of or as close to the limits of the floodplain as feasible to decrease the reduction of conveyance capacity of the Kern River.
- Bridges would be designed with sufficient freeboard above the 100-year flood Water Surface Elevation to prevent the bridge deck from impacting flood flows.
- Culvert drainage facilities would be installed underneath alignment embankments, where required, to maintain existing storm water runoff patterns in the study area.

Section 6 Conclusions and Recommendations

This floodplain evaluation has considered the effects of the build alternatives in terms of encroachment, interruption, and risk and concluded that a significant encroachment does not exist; there is no significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles; there is a low risk to natural resources; and there would be no significant impacts on natural and beneficial floodplain values.

Section 7 List of Preparers and Contributors

Richard Bottcher, P.E., Regional Storm Water Manager. Masters of Engineering, Cornell University, 28 years of storm water management experience. Contribution: Principal Author.

Dan Conaty, Technical Editor. M.A., Geography, San Diego State University; 30 years of environmental planning experience. Contribution: Technical Editor.

Anne Kochaon, QEP, Project Manager. M.S., Environmental Engineering, Asian Institute of Technology, Thailand; 26 years of experience in environmental planning and impact analysis. Contribution: Peer Reviewer, quality assurance/ quality control.

Qiaohong Lu, Senior Drainage Engineer. M.S., Civil Engineering, Clemson University; 9 years of experience in drainage engineering. Contribution: Hydraulic Engineering.

Section 8 References

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WRECO 2010	Draft Location Hydraulic Study Report, Proposed Bridge Crossing over Kern River, Centennial Corridor Project, Bakersfield, California. March.

Appendix A HEC-RAS Results

Existing Conditions:

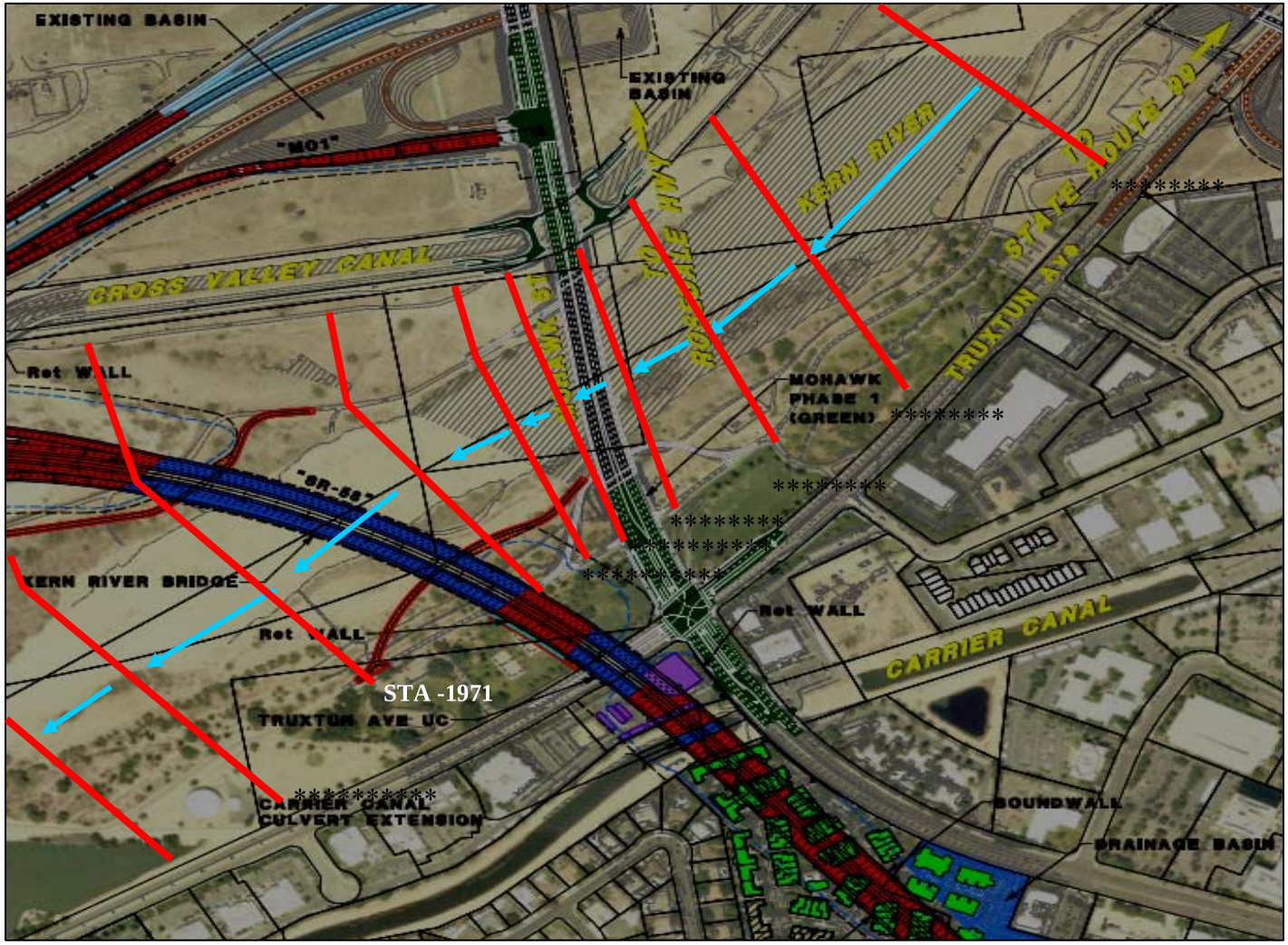
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.10	389.86	395.44	0.000868	4.64	3232.27	412.00	0.29
KR 1	2649.70	EIR Q100	15000.00	385.31	394.67	389.81	395.12	0.001227	5.34	2806.71	345.84	0.33
KR 1	2485.4	EIR Q100	15000.00	384.91	394.63	389.03	394.91	0.000788	4.21	3563.86	533.50	0.29
KR 1	2389.28	EIR Q100	15000.00	384.80	394.62	388.63	394.83	0.000534	3.66	4093.06	511.85	0.23
KR 1	2142.52	EIR Q100	15000.00	384.80	394.46	388.50	394.69	0.000555	3.88	3867.00	426.37	0.23
KR 1	1811.506	EIR Q100	15000.00	384.80	393.84	389.45	394.20	0.001326	4.79	3128.41	413.38	0.31
KR 1	1557.67	EIR Q100	15000.00	383.50	393.59	388.37	393.92	0.000872	4.57	3283.57	414.57	0.29
KR 1	1527.865		Bridge									
KR 1	1498.17	EIR Q100	15000.00	383.20	393.48	388.41	393.83	0.000993	4.77	3147.23	391.59	0.30
KR 1	1388.25	EIR Q100	15000.00	384.36	393.41	388.38	393.71	0.000868	4.38	3421.23	441.90	0.28
KR 1	1293.24	EIR Q100	15000.00	383.50	392.87	389.47	393.54	0.002400	6.61	2270.43	376.33	0.47
KR 1	1254.20		Bridge									
KR 1	1224.1	EIR Q100	15000.00	384.30	392.47	389.66	393.27	0.003004	7.19	2085.94	314.97	0.49
KR 1	700.69	EIR Q100	15000.00	384.05	391.91	387.69	392.25	0.001080	4.66	3219.32	446.87	0.31
KR 1	0	EIR Q100	15000.00	382.85	391.43	386.77	391.62	0.000655	3.50	4290.64	664.21	0.24
KR 1	-446.17	EIR Q100	15000.00	381.76	391.12	386.42	391.32	0.000693	3.56	4219.33	605.13	0.24
KR 1	-971	EIR Q100	15000.00	381.57	390.75	386.41	391.03	0.001300	4.29	3499.67	596.10	0.31
KR 1	-1046		Bridge									
KR 1	-1121	EIR Q100	15000.00	381.63	390.32		390.57	0.001099	4.05	3706.53	694.62	0.31
KR 1	-1271	EIR Q100	15000.00	381.29	390.17	386.05	390.41	0.001028	3.89	3851.69	736.00	0.30
KR 1	-1471	EIR Q100	15000.00	380.84	390.00	385.82	390.21	0.000903	3.68	4078.64	745.57	0.28
KR 1	-1971	EIR Q100	15000.00	380.82	389.68	385.18	389.81	0.000619	2.88	5207.03	916.35	0.21
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21

Alternative A:

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.12	389.86	395.45	0.000864	4.63	3237.79	416.32	0.29
KR 1	2649.70	EIR Q100	15000.00	385.31	394.69	389.81	395.13	0.001222	5.33	2812.02	346.28	0.33
KR 1	2485.4	EIR Q100	15000.00	384.91	394.65	389.03	394.92	0.000783	4.20	3572.42	535.05	0.29
KR 1	2389.28	EIR Q100	15000.00	384.80	394.63	388.63	394.84	0.000531	3.66	4101.30	512.27	0.23
KR 1	2142.52	EIR Q100	15000.00	384.80	394.47	388.50	394.70	0.000552	3.87	3874.10	426.45	0.23
KR 1	1811.506	EIR Q100	15000.00	384.80	393.91	389.45	394.26	0.001038	4.75	3157.18	416.00	0.30
KR 1	1557.67	EIR Q100	15000.00	383.50	393.70	388.37	394.01	0.000840	4.51	3326.92	417.20	0.28
KR 1	1527.865		Bridge									
KR 1	1498.17	EIR Q100	15000.00	383.20	393.58	388.41	393.93	0.000954	4.70	3189.78	393.68	0.29
KR 1	1388.25	EIR Q100	15000.00	384.36	393.52	388.38	393.81	0.000831	4.32	3470.77	443.46	0.27
KR 1	1293.24	EIR Q100	15000.00	383.50	393.01	389.47	393.65	0.002264	6.45	2325.08	386.48	0.46
KR 1	1254.20		Bridge									
KR 1	1224.1	EIR Q100	15000.00	384.30	392.64	389.66	393.40	0.002793	7.01	2139.31	317.88	0.48
KR 1	700.69	EIR Q100	15000.00	384.05	392.14	387.69	392.46	0.000979	4.51	3322.75	449.02	0.29
KR 1	0	EIR Q100	15000.00	382.85	391.72		391.90	0.000576	3.34	4487.47	687.66	0.23
KR 1	-446.17	EIR Q100	15000.00	381.76	391.45		391.63	0.000608	3.39	4422.25	627.69	0.23
KR 1	-971	EIR Q100	15000.00	381.57	391.12	386.41	391.37	0.001266	4.02	3731.03	672.56	0.30
KR 1	-1046		Bridge									
KR 1	-1121	EIR Q100	15000.00	381.63	390.74		390.96	0.000904	3.74	4009.30	728.60	0.28
KR 1	-1271	EIR Q100	15000.00	381.29	390.63	386.05	390.83	0.000821	3.58	4189.03	741.04	0.27
KR 1	-1471	EIR Q100	15000.00	380.84	390.35	386.24	390.63	0.001135	4.21	3559.60	616.81	0.31
KR 1	-1900		Bridge									
KR 1	-1971	EIR Q100	15000.00	380.82	389.69	385.58	389.89	0.000919	3.51	4273.42	750.72	0.26
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21

*Maximum c***change in Water Surface = 0.35 ft upstream of new bridge (Station -1471).**

Alternative A: HEC-RAS Cross Sections at Proposed Bridge

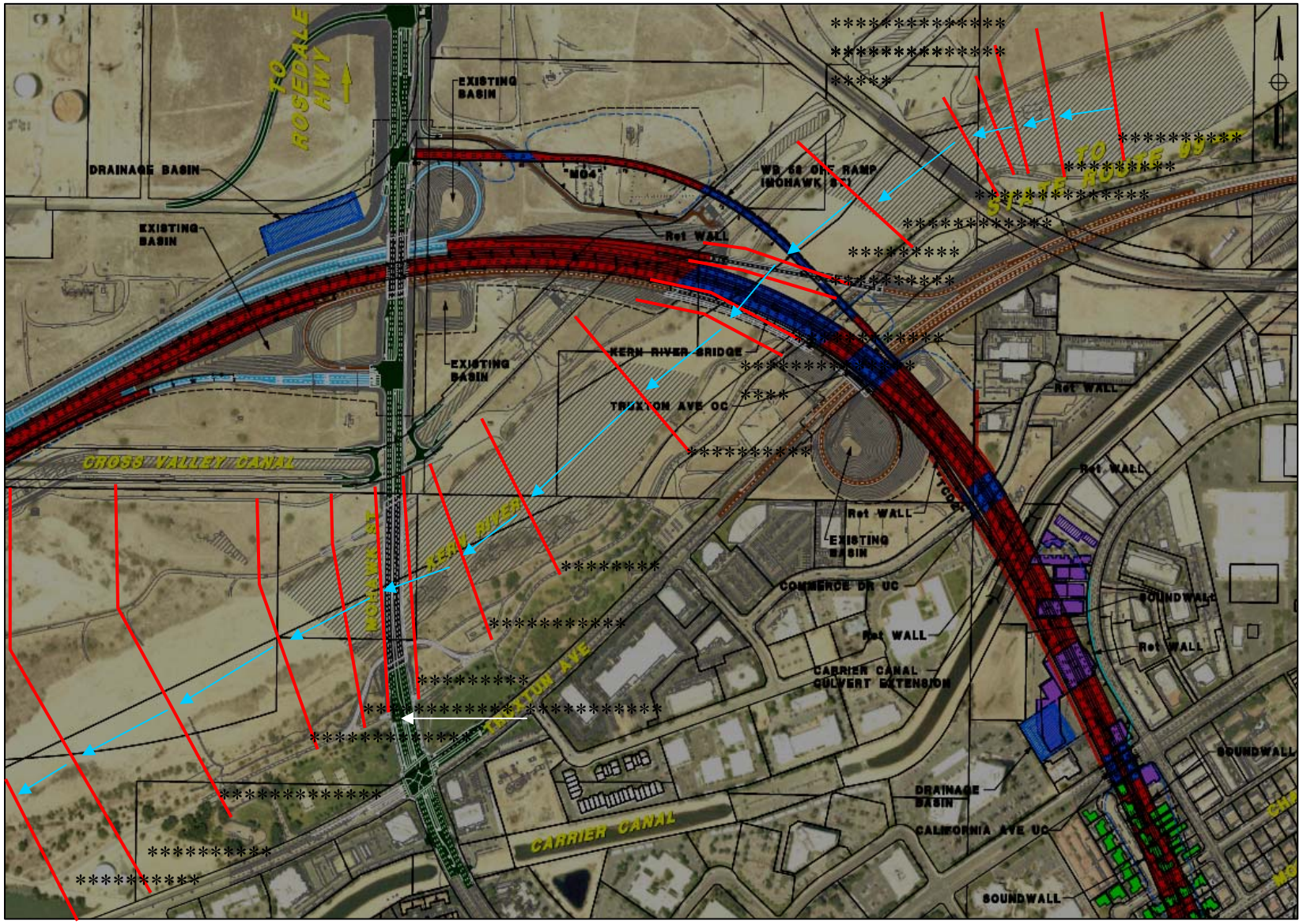


Alternative B:

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.17	389.86	395.50	0.000848	4.60	3260.68	433.77	0.30
KR 1	2649.70	EIR Q100	15000.00	385.31	394.75	389.81	395.19	0.001200	5.29	2833.62	354.33	0.33
KR 1	2485.4	EIR Q100	15000.00	384.91	394.71	389.03	394.98	0.000763	4.16	3607.02	541.41	0.28
KR 1	2389.28	EIR Q100	15000.00	384.80	394.70	388.63	394.90	0.000518	3.63	4134.37	513.96	0.23
KR 1	2142.52	EIR Q100	15000.00	384.80	394.54	388.50	394.77	0.000539	3.84	3903.02	426.76	0.22
KR 1	1811.506	EIR Q100	15000.00	384.80	393.99	389.45	394.34	0.001004	4.70	3192.45	419.19	0.30
KR 1	1607.37		Bridge									
KR 1	1557.67	EIR Q100	15000.00	383.50	393.71	388.37	394.03	0.000835	4.50	3333.71	417.61	0.28
KR 1	1527.865		Bridge									
KR 1	1498.17	EIR Q100	15000.00	383.20	393.60	388.41	393.94	0.000949	4.69	3196.44	394.05	0.29
KR 1	1364.24		Bridge									
KR 1	1293.24	EIR Q100	15000.00	383.50	392.87	389.47	393.54	0.002400	6.61	2270.43	376.33	0.47
KR 1	1254.20		Bridge									
KR 1	1224.1	EIR Q100	15000.00	384.30	392.47	389.66	393.27	0.003004	7.19	2085.94	314.97	0.49
KR 1	700.69	EIR Q100	15000.00	384.05	391.91	387.69	392.25	0.001080	4.66	3219.32	446.87	0.31
KR 1	0	EIR Q100	15000.00	382.85	391.43	386.77	391.62	0.000655	3.50	4290.64	664.21	0.24
KR 1	-446.17	EIR Q100	15000.00	381.76	391.12	386.42	391.32	0.000693	3.56	4219.33	605.13	0.24
KR 1	-971	EIR Q100	15000.00	381.57	390.75	386.41	391.03	0.001300	4.29	3499.67	596.10	0.31
KR 1	-1046		Bridge									
KR 1	-1121	EIR Q100	15000.00	381.63	390.32		390.57	0.001099	4.05	3706.53	694.62	0.31
KR 1	-1271	EIR Q100	15000.00	381.29	390.17	386.05	390.41	0.001028	3.89	3851.69	736.00	0.30
KR 1	-1471	EIR Q100	15000.00	380.84	390.00	385.82	390.21	0.000903	3.68	4078.64	745.57	0.28
KR 1	-1971	EIR Q100	15000.00	380.82	389.68	385.18	389.81	0.000619	2.88	5207.03	916.35	0.21
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21

*Maximum c***change in Water Surface = 0.15 ft upstream of new bridges (Station 1811).**

Alternative B: HEC-RAS Cross Sections at Proposed Bridge Sites

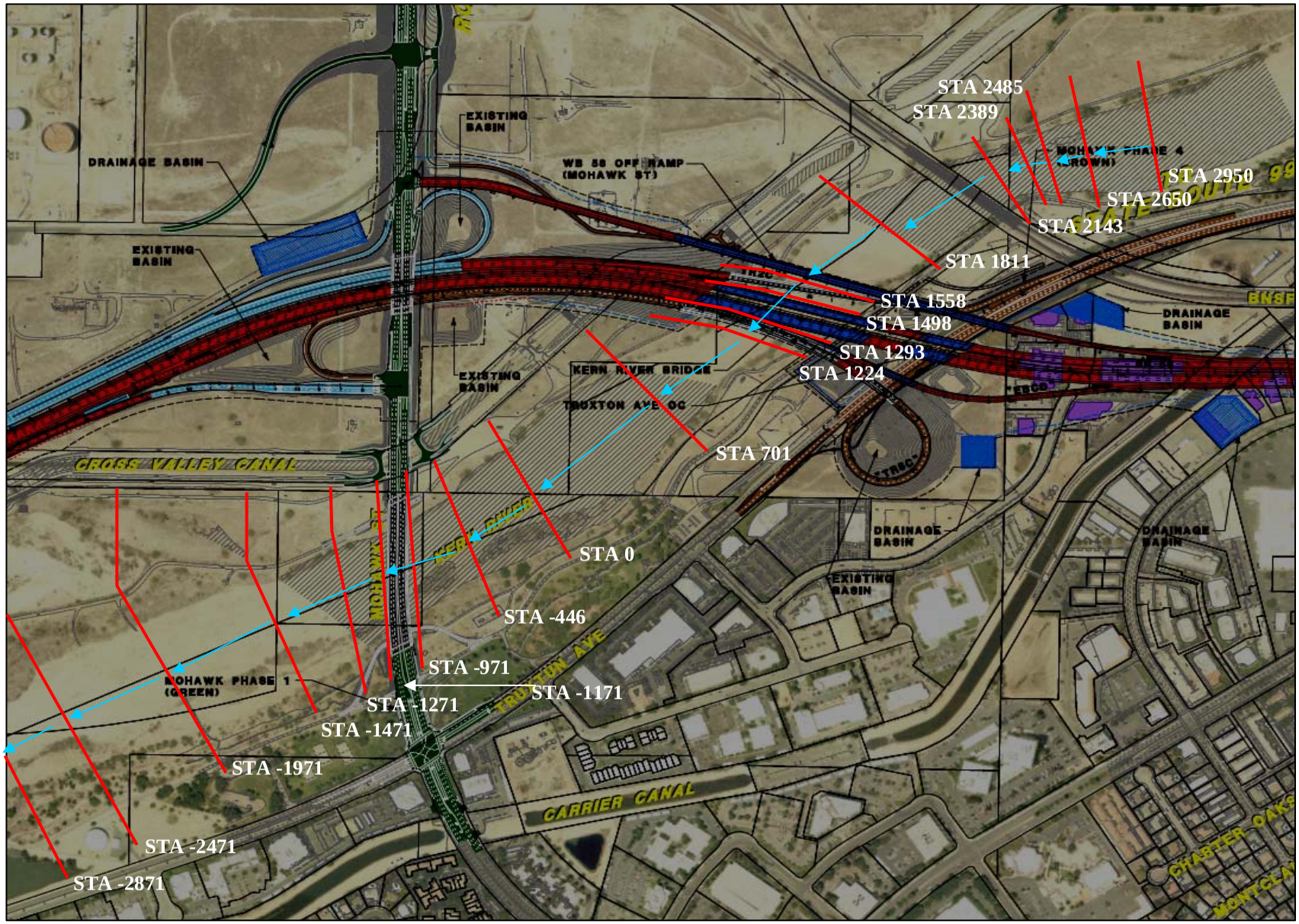


Alternative C:

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Chl
KR 1	2950	EIR Q100	15000.00	385.84	395.20	389.86	395.53	0.000839	4.58	3274.08	443.68	0.30	
KR 1	2649.70	EIR Q100	15000.00	385.31	394.79	389.81	395.22	0.001187	5.27	2846.10	359.61	0.33	
KR 1	2485.4	EIR Q100	15000.00	384.91	394.75	389.03	395.01	0.000752	4.14	3626.89	552.10	0.28	
KR 1	2389.28	EIR Q100	15000.00	384.80	394.73	388.63	394.94	0.000512	3.61	4153.10	514.91	0.22	
KR 1	2142.52	EIR Q100	15000.00	384.80	394.58	388.50	394.81	0.000532	3.83	3919.39	426.93	0.22	
KR 1	1811.506	EIR Q100	15000.00	384.80	393.99	389.45	394.33	0.001284	4.70	3190.43	419.01	0.30	
KR 1	1607.37		Bridge										
KR 1	1557.67	EIR Q100	15000.00	383.50	393.69	388.37	394.00	0.000844	4.52	3321.48	416.87	0.28	
KR 1	1527.865		Bridge										
KR 1	1498.17	EIR Q100	15000.00	383.20	393.57	388.41	393.91	0.000959	4.71	3184.43	393.39	0.29	
KR 1	1372.24		Bridge										
KR 1	1293.24	EIR Q100	15000.00	383.50	392.87	389.47	393.54	0.002400	6.61	2270.43	376.33	0.47	
KR 1	1254.20		Bridge										
KR 1	1224.1	EIR Q100	15000.00	384.30	392.47	389.66	393.27	0.003004	7.19	2085.94	314.97	0.49	
KR 1	700.69	EIR Q100	15000.00	384.05	391.91	387.69	392.25	0.001080	4.66	3219.32	446.87	0.31	
KR 1	0	EIR Q100	15000.00	382.85	391.43	386.77	391.62	0.000655	3.50	4290.64	664.21	0.24	
KR 1	-446.17	EIR Q100	15000.00	381.76	391.12	386.42	391.32	0.000693	3.56	4219.33	605.13	0.24	
KR 1	-971	EIR Q100	15000.00	381.57	390.75	386.41	391.03	0.001300	4.29	3499.67	596.10	0.31	
KR 1	-1046		Bridge										
KR 1	-1121	EIR Q100	15000.00	381.63	390.32		390.57	0.001099	4.05	3706.53	694.62	0.31	
KR 1	-1271	EIR Q100	15000.00	381.29	390.17	386.05	390.41	0.001028	3.89	3851.69	736.00	0.30	
KR 1	-1471	EIR Q100	15000.00	380.84	390.00	385.82	390.21	0.000903	3.68	4078.64	745.57	0.28	
KR 1	-1971	EIR Q100	15000.00	380.82	389.68	385.18	389.81	0.000619	2.88	5207.03	916.35	0.21	
KR 1	-2471	EIR Q100	15000.00	380.15	389.38	384.63	389.52	0.000545	2.97	5042.68	903.47	0.22	
KR 1	-2871	EIR Q100	15000.00	379.62	389.17	384.71	389.29	0.000580	2.79	5371.78	945.75	0.21	

*Maximum c***change in Water Surface = 0.15 ft upstream of new bridges (Station 1811).**

Alternative C: HEC-RAS Cross Sections at Proposed Bridge Sites



Appendix B Floodplain Impact Assessment Segment 2 Technical Memorandum

CENTENNIAL CORRIDOR PROJECT

Floodplain Impact Assessment
Segment 2
Technical Memorandum

December 2011

1.0 PURPOSE OF THE TECHNICAL MEMORANDUM

In January 2007, the Westside Parkway Final Environmental Assessment (EA) and Environmental Impact Report (EIR) was completed and approved by the Federal Highway Administration (FHWA), California Department of Transportation (Caltrans), and City of Bakersfield (City). This document evaluated environmental impacts for the proposed 8.1-mile-long east-west freeway that extends from Heath Road at Stockdale Highway to a point near State Route (SR) 99 at Truxtun Avenue in Bakersfield and an unincorporated portion of Kern County. Since approval of the EA/EIR, a number of design refinements have been necessary and revalidation reports were prepared to assess the potential environmental impacts associated with the design refinements. As part of the Centennial Corridor Project, additional design refinements to Westside Parkway are proposed. These are discussed in Section 2.0, Change in Project Design.

This Floodplain Impact Assessment Technical Memorandum was prepared to assess the changes in the environmental setting, circumstances, impacts, and avoidance, minimization or mitigation measures resulting from the project's design refinements as compared to the approved 2007 EA/EIR.

2.0 CHANGE IN PROJECT DESIGN

Westside Parkway is under construction. Incorporation of the road as part of Centennial Corridor would require minor modifications to the approved design plans. This would include the addition of auxiliary lanes and changes to ramps. The impacts, however, associated with these improvements are being addressed as part of

Segment 1. This technical memorandum is focused on the potential impacts associated with the designation of the roadway as SR 58 and providing the connection to the existing SR 58 freeway, SR 99, and ultimately to Interstate 5 (I-5).

3.0 CHANGE IN ENVIRONMENTAL SETTING

Based on an evaluation of exhibits that display the 2009 project design refinements for Westside Parkway, the environmental setting pertaining to water resources remains unchanged from that described in the approved 2007 EA/EIR.

4.0 CHANGE IN ENVIRONMENTAL CIRCUMSTANCES

Designating Westside Parkway as SR 58 and creating a connection to the existing SR 58, SR 99, and ultimately to I-5 would cause no changes in environmental circumstances pertaining to floodplains. The designation as SR 58 would not increase the roadway's footprint; hence, no surface water resources would be impacted as a result of the change in designation.

5.0 CHANGE IN ENVIRONMENTAL IMPACT

Segment 2 longitudinally encroaches on the Kern River floodplain between the Friant-Kern Canal and Mohawk Street. Specifically, the alignment encroaches on an overflow area of the 100-year floodplain caused by backwater resulting from the river's constriction.

To determine the impacts of the proposed Westside Parkway encroachments on the Kern River floodplain, preparers of the *Westside Parkway Environmental Assessment/Final Environmental Impact Report* (2006) utilized HEC-RAS modeling software to evaluate the 100-year flood baseline (existing) and 100-year flood under proposed conditions. The results of the analysis indicated that Westside Parkway would not involve a substantial encroachment of the 100-year floodplain because the encroachments would not result in flooding risks, impacts to natural floodplain values, support of incompatible floodplain development, or potential for interruption or termination of a transportation facility in the event of flooding. Additionally, as discussed in the *Westside Parkway Location Hydraulic Study* prepared by the City of Bakersfield Public Works Department (2006), this area is not within the main flow path of the Kern River floodplain and has no effect on the river's hydraulic characteristics at peak flows. Since the only encroachment into the Zone AE Floodplain for Segment 2 occurs outside the main flood flow path, impacts to the existing hydraulic characteristics of the Kern River floodplain are not expected. Since there are no changes to the alignment of Segment 2 as part of this project, the

environmental analysis presented in the *Westside Parkway Environmental Assessment/Final Environmental Impact Report* (2006) remains valid.

6.0 CHANGE TO AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES SINCE LAST DOCUMENT WAS APPROVED

No new or additional avoidance and minimization measures would be required when redesignating Westside Parkway to SR 58.

7.0 CHANGE TO ENVIRONMENTAL COMMITMENT SINCE LAST DOCUMENT WAS APPROVED

No changes to environmental commitments arise from the design changes to the Westside Parkway studied for this revalidation report on floodplains.

8.0 LIST OF PREPARERS

Richard Bottcher, P.E., Regional Storm Water Manager, Masters of Engineering, 28 years of storm water management experience. Contribution: Principal Author.

Anne Kochaon, QEP, Project Manager, M.S. Environmental Engineering, 25 years of experience. Contribution: QA/QC Reviewer.

9.0 REFERENCES

California Department of Transportation, Federal Highway Administration, and Kern Council of Governments (Caltrans *et al.*). 2002. *Final Route 58 Route Adoption Project: A Tier I Environmental Impact Statement/Environmental Impact Report.* Fresno, CA: Caltrans, FHWA, and Kern COG.

Appendix C Floodplain Impact Assessment Segment 3 Technical Memorandum

CENTENNIAL CORRIDOR PROJECT

Floodplain Impact Assessment
Segment 3
Technical Memorandum

December 2011

1.0 PURPOSE OF THE TECHNICAL MEMORANDUM

The California Department of Transportation (Caltrans) proposes to establish a new alignment for State Route (SR) 58, which would provide a continuous route along SR 58 from Interstate 5 (I-5) via Westside Parkway to Cottonwood Road on existing SR 58, east of SR 99 (post miles T31.7 to R55.4). Improvements to SR 99 (post mile 21.2 to 26.2) would also be required to accommodate the connection with SR 58. The proposed continuous route, known as the Centennial Corridor, has been divided into three distinct segments. The segments of the corridor are shown in Figure 1-1 of the Floodplain Evaluation Report for Segment 1. Segment 2 is composed of Westside Parkway and extends from approximately Mohawk Street to Heath Road, which is currently under construction. This segment would be transferred into the State Highway System.

Segment 3, the focus of this Technical Memorandum, extends from Heath Road to I-5. The construction timing for this segment is unknown, but construction would not occur until there is sufficient funding and greater traffic demand. Therefore, the analysis of Segment 3 has been done at a conceptual level (Tier 1[3]). The approval

[3] A Tier I document evaluates the impacts at a programmatic level (i.e., conceptual level). This approach is used when facility construction is not anticipated in the foreseeable future. The Tier I document allows the preservation and acquisition of right-of-way. As such, a Tier I document is not adequate to address construction-level impacts. Therefore, subsequent documentation will be required before the project can move forward into the detailed engineering phase.

being sought is route adoption, with more detailed analysis occurring at the time construction is proposed.

An alignment for Segment 3 was identified as part of the 2002 *Route 58 Route Adoption Project, Tier 1 Environmental Impact Statement/Environmental Impact Report (EIS/EIR)*. The analysis contained herein will incorporate the results of that study. A Tier II (project-level) document will be prepared for Segment 3 as a separate documentation effort at a later time when funding becomes available.

Information on Segment 3 was obtained from the *Route 58 Route Adoption Project Tier I EIR/EIS* (Caltrans *et al.* 2002). Based on the Tier I route adoption evaluation, the Cross Valley Canal Option was selected as the Least Damaging Practicable Alternative and will be addressed in this analysis.

2.0 PROJECT DESCRIPTION

The study area for this technical memorandum consists of the Segment 3 alignment (Cross Valley Canal Option). The alignment generally follows the Cross Valley Canal, which is south of the alignment, from Westside Parkway's (Segment 2) planned terminus at Heath Road, west to I-5. From Westside Parkway's terminus, the alignment would angle southwest to Heath Road and then assume an east-west direction for approximately 6 miles before angling slightly southwest for approximately 1.5 miles to its ultimate connection with I-5 near the Cross Valley Canal.

3.0 CHANGE IN ENVIRONMENTAL SETTING

The environmental setting pertaining to water resources remains unchanged from that described in the 2002 EIS/EIR.

4.0 CHANGE IN ENVIRONMENTAL CIRCUMSTANCES

There have been no changes in environmental circumstances for water resources, including floodplains, since the 2002 EIS/EIR was approved.

5.0 CHANGE IN ENVIRONMENTAL IMPACT

The currently proposed alignment for Segment 3 would not encroach on the Kern River floodplain; therefore, there are no floodplain impacts associated with Segment 3. No new floodplain impacts would result from the proposed alignment for Segment 3. If it is determined during preparation of the Tier 2 environmental document that the alignment for Segment 3 would encroach on the 100-year floodplain, then additional floodplain studies would be prepared. In the current

condition, Stockdale Highway would be used as an interim connection between Segment 2 and I-5.

6.0 CHANGE TO AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES SINCE LAST DOCUMENT WAS APPROVED

Given that the environmental documentation for Segment 3 was conducted at a conceptual level, avoidance, minimization, and mitigation measures described in the approved EIS/EIR are still valid. No new or additional avoidance, minimization, and mitigation measures would be required as a result of incorporation of Segment 3 as part of the Centennial Corridor.

7.0 CHANGE TO ENVIRONMENTAL COMMITMENT SINCE LAST DOCUMENT WAS APPROVED

No changes in environmental commitments concerning floodplains have occurred since the approval of the 2002 EIS/EIR.

8.0 LIST OF PREPARERS

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9.0 REFERENCES

California Department of Transportation, Federal Highway Administration, and Kern Council of Governments (Caltrans et al.). 2002. *Final Route 58 Route Adoption Project: A Tier I Environmental Impact Statement/Environmental Impact Report.* Fresno, CA: Caltrans, FHWA, and Kern COG.

Central Valley Flood Protection Board Free Board Requirements. www.cvfpb.ca.gov/meetings/2008/011108-item10-11a-staffreport.pdf.